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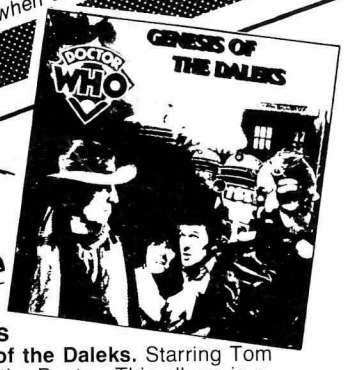

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SPACE VOYAGER

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We regret that due to circumstances beyond our control we are unable to publish Mark Gorton's regular 'SF on Video' column or 'Terrahawks' feature in this issue.

Front cover illustration by David Hardy. For more of David Hardy's work, see page 34. Back cover: A scene from Star Trek II – The Wrath of Khan. United International Pictures (UK)

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CAPTAIN'S LOG

Films, television, models, spaceflight, astronomy, books, computer software and conventions – that's the June/July *Space Voyager* line-up. Let's take that again in slightly more detail. Patrick Moore has some encouraging advice for the astronomy enthusiast with a very tiny budget. On the television theme, freelance journalist Wendy Graham (no relation) interviews the sixth television Dr Who (Colin Baker), his companion, Peri (Nicola Bryant) and Dr Who producer John Nathan-Turner.

David Hardy predicts how astronauts will explore Mars in an article illustrated with his excellent space paintings. Meanwhile, a little closer to home, Dr J K Davies reveals that, while we are celebrating the success of the Space Shuttle and Spacelab to the exclusion of almost every other space effort in our respective western countries, Japan is steadily following an extensive space programme of its own. Another scientist, Dr Conway Snyder, worked on the Viking project that landed two spacecraft on Mars. He reveals how the Vikings were transported to Mars and what they found when they got there.

What have I been doing to earn my crust? Well, this time round I've learnt a thing or two about the European Ariane launch rocket and made one of my rare visits into London to sample a film preview. The film was one that I've been eagerly awaiting since I read the book in 1981 – Tom Wolfe's The Right Stuff. I've also been sampling computer software for the extremely popular Sinclair ZX Spectrum and the relatively new Acorn Electron. The Electron is so new that there is very little software available for it yet and that is reflected in the balance of Spectrum/Electron software in Micro Wars.

I've also been fortunate enough to lay my hands on the first batch of photographs of the Earth taken by Spacelab-1 to be released by the European Space Agency. They're stunning.

April/May *Space Voyager*

Reactions on the last issue are beginning to come in. Most are favourable (phew, what a relief). You pick out the Model Rocketry, Model Madness and Shuttle Update/Spacelab articles for special commendation. I've passed your comments on to Peter Freebrey, the author of Model Rocketry. Modesty prevents me from revealing the Spacelab author's name.

The flood of entries for Astro-Guiz are beginning to pour into castle Voyager's capacious mail dungeon. We keep failed advertisement managers down there knee deep in compost doing menial jobs like opening and checking the competition entries. A few entries for the caption competition have also turned up. I can now reveal the nature of the mystery prize which the author of the most original caption will be awarded. You've all seen competitions offering prizes like a fortnight's cruise for two in the Caribbean, a souped-up, super-powerful sports car or even a luxury home. The caption competition winner's prize outdoes all of those – it's a one year subscription to *Space Voyager.*

Silly-comps

This issue's silly-comp concerns the extraordinary conduct of Ash towards Ripley in the 20th Century-Fox film *Alien.* If you saw the film, you know what was going on and if you haven't seen it, I'm not going to spoil it by telling you. But imagine what might be happening. Perhaps it's the scene in an upmarket hair salon – Ripley is trying out the latest in root stimulation. Perhaps Ripley has just beaten Ash's best Space Raiders score and he's exacting retribution (understandable). Perhaps she's been on the phone to her mother on Mars for half an hour and it's Ash's turn to pay the phone bill. The possibilities are endless.

The most original caption for this photograph received by first post on June 11th will win a year's subscription to *Space Voyager.* The editor's decision is final and no correspondence will be entered into. Send your entries to:

Caption Competition
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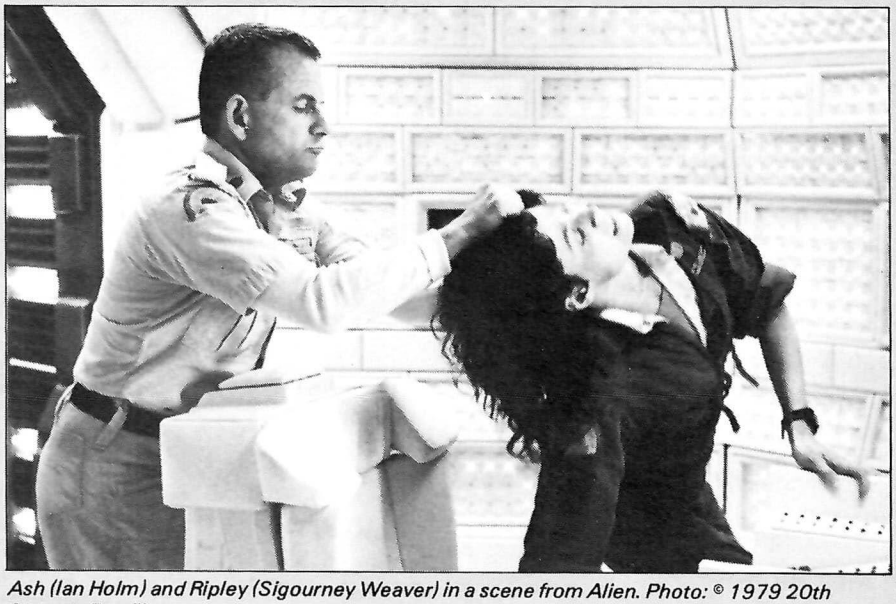
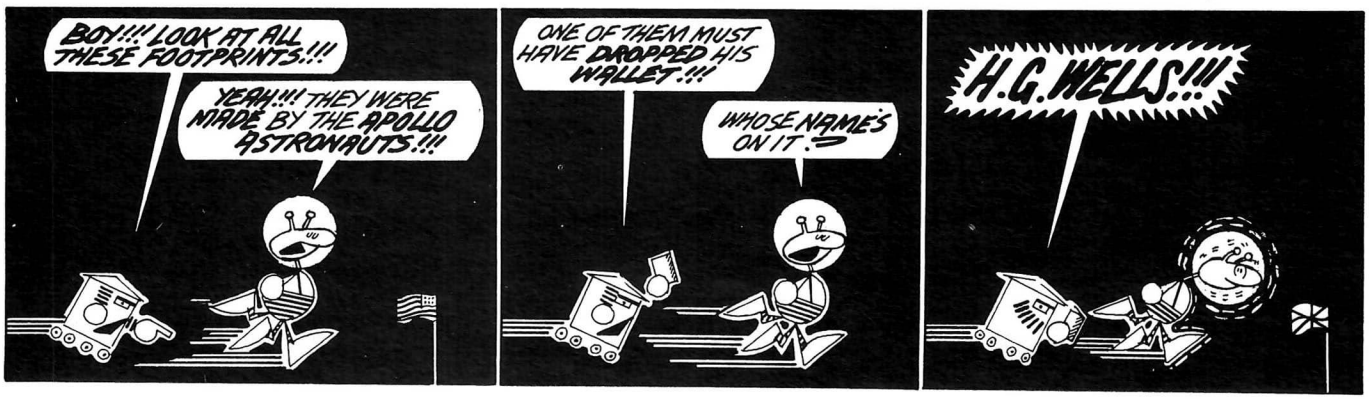


Ash (Ian Holm) and Ripley (Sigourney Weaver) in a scene from Alien. Photo: © 1979 20th Century-Fox film

PLUTONIUM PETE

By ROBINSON


BOY!!! LOOK AT ALL THESE FOOTPRINTS.!!!
YEAH!!! THEY WERE MADE BY THE APOLLO ASTRONAUTS!!!
ONE OF THEM MUST HAVE DROPPED HIS WALLET!!!
WHOSE NAME'S ON IT.?
H.G. WELLS!!!

DATA BANK

On-line space news

Spaceline, a recorded information service for skywatchers, has been launched by British Telecom. The latest addition to Telecom's 'dial-a-something' service is available 24 hours a day by dialling 01-246 8055.

It will be updated every week to keep enthusiasts informed of planetary positions, space shuttle flights and satellite launches, and anything else of interest in the heavens. Spaceline's script is written by leading space scientist Dr David Whitehouse, who has worked closely with NASA and ESA. Space expert Dr Gary Hunt read the first week's information.

Solar sailing

Work on the British scientific spacecraft AMPTE, due to be launched in August 1984, has moved on a stage with completion of testing in British Aerospace's electromagnetic test facility in Bristol.

AMPTE (Active Magnetic Particle Tracer Explorer) is one of three spacecraft that will investigate how solar wind ions penetrate the barrier of the Earth's magnetic field and cause aurorae. The other two are being contributed by Germany and the United States.

The British craft is being developed by the Science and Engineering Research Council's Rutherford Appleton Lab and the Mullard Science Lab. The three satellites will orbit a few hundred kilometres apart. One of them, the German satellite, will release lithium and barium atoms into the solar wind. The resulting positive ions will act as tracers for detection by the American satellite in orbit nearer the Earth. The mission is due to last a year with seven matter releases planned.

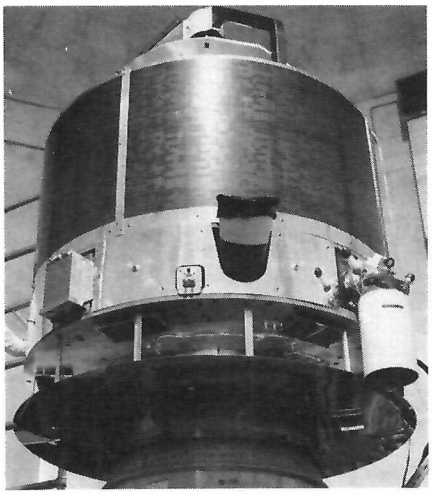
Space convention

The British Interplanetary Society is holding its second convention in Brighton in November 1985. With a theme of 'Space – The Future of Mankind', Space '84 will be held at the Brighton Centre on November 16-18. There are 400 places and further details are available from the Executive Secretary, British Interplanetary Society, 27/29 South Lambeth Road, London SW8 1SZ.

Giotto takes shape

Comprehensive electrical and electromagnetic tests have been successfully completed on the full-scale electrical engineering version of Giotto – the spacecraft that will meet Halley's comet in 1986. The tests, carried out at British Aerospace's Electromagnetic Compatibility Test facility in Bristol, confirmed that the various experiments carried on the spacecraft will not interfere with each other.

The electrical engineering model is the second test version of Giotto to be built. The first was essentially a structural test-bed. The third version will be the flight model, which will be launched by an Ariane 1 rocket from the Guiana space centre in July 1985. By then, the Giotto programme will have cost about £34 million.



ESA satellite Giotto takes shape in British Aerospace's Bristol test facility. Photo: British Aerospace

Model Craft & Country Show

This year's Model Craft & Country Show, to be staged in the heart of England at the Royal Agricultural Centre at Stoneleigh, Warwickshire from May 26th to 28th this year, will have an important new emphasis.

To satisfy the practising modeller's hunger for knowledge of his craft and the would-be modeller's lack of knowledge, this year's exhibition and all its outdoor events will concentrate on 'how to do it'. This departure from the conventional exhibition style was prompted by research carried out by the organisers, Argus Specialist Exhibitions, among modellers and interested non-modellers.

Extra space is being offered to exhibitors free of charge providing they use it to give demonstrations or talks. Thus there will be less emphasis on merely looking at finished models. The organisers themselves are arranging a wide range of lectures and demonstrations to help people of all ages get started in modelling and show how models are made.

Last year over 35 000 visitors came to the show, which this year will cover model engineering, railways, boats, aeroplanes, cars, military models, scale models and wargaming. Outside, there will be a non-stop radio controlled flying programme and model car and boating demonstrations including teaching sessions.

The show is open from 9am to 6pm each day. Car parking is free and the entry charge stays at last year's level – £2.00 for adults, £1.00 for children and OAPs.

Star Trek returns

Latest news from the BBC is that they have once again bought the rights to televise Star Trek. Details of the episodes concerned and transmission dates are not yet available – watch this space.

Giant Japanese rocket

The Japanese government has announced plans to build a rocket capable of placing a two

CONVENTION CALENDAR
by Marion van de Voort

May 25-28 TYNECON II, SF. Newcastle upon Tyne. Write: Sue Williams, 19, Jesmond Dene Road, Jesmond, NOT NE2 3QT

June 2 COMIC MART. Central Hall, Westminster, London SW1. Afternoon only. Free admission

July 20-23 ALBACON 84, SF. Glasgow. Guests: Harlan Ellison. Write: Ms F J Nelson, 62 Campsie Road, Wishaw ML2 7QC

July 20-23 FAIRCON 84, SF, Glasgow. Guests: Sydney Jordan and Mat Irvine. Write: Bob Shaw, 2/1 244 West Princes Street, Kelvinbridge, Glasgow G4 9DP

Aug 4-5 THE LEISURE Hive, Dr Who, Swindon. Write: Tony Cherrington, 2, Domestic Quarters, Bryanston School, BLANDFORD, Dorset

Aug 17-19 FANDERSON 84, Gerry Anderson. London. Write: P.O. Box 308, London W4 1QL

Aug 24-26 GALILEO CON 84, Star Trek. Newcastle Upon Tyne. Guests: Gene Roddenberry & Majel Barrett. Write: Catherine Richardson, 30, Kirkdale Green, Rye Hill Estate, NOT NE4 6HU

Aug 24-27 OXCON, SF. Oxford. (Unicon 5) Guests: Brian Aldiss. Write: Keith Clements. 121 Drews Lane, Ward End, BIRMINGHAM B8 2QF

Aug 4 COMIC MART. As June 2

Sep 7-9 MYTHCON, Fantasy. Hull. Guests: Anne McCaffrey, Brian Froud, Dr Jack Cohen. Write: Marion van der Voort, 133 Sheen Lane, London SW14 8AE

Oct 6 VILACON 84. Blakes 7. Southampton. Write Fiona McArthur, 15 Hazel Close, Charlesford, Hants

Oct 12-14 CONQUEST, mainly Elfquest. Glasgow. Guests: Richard & Wendy Pini. Write: Pat Brown, 104, Pretoria Road, Patchway BRISTOL BS12 5PZ

Oct 12-14 MIDCON 84. Star Trek. Leicester. Guests: George Takei and Bruce Hyde. Write Terry Elson: 8 Ennerdale Close, Oadby, LEICESTER, LE2 4TN

Oct 13 COMIC MART. As June 2

Oct 27-28 GALACTICON 84, Blakes' 7 and Battlestar Galactica. Write Eileen Wingrove, 334 Parkside Avenue, Barnehurst, Bexleyheath, Kent

Nov 9-11 NOVACON 14, SF. Birmingham. Guests: Robert Holdstock. Write: 11, Fox Green Crescent, Acocks Green, Birmingham 27

Dec 8 COMIC MART. As June 2

Dec 14-16 SANTACON, Media. Leeds. Write: Santacon, 84, Ambrose Street, Fulford Road, YORK YO1 4DR

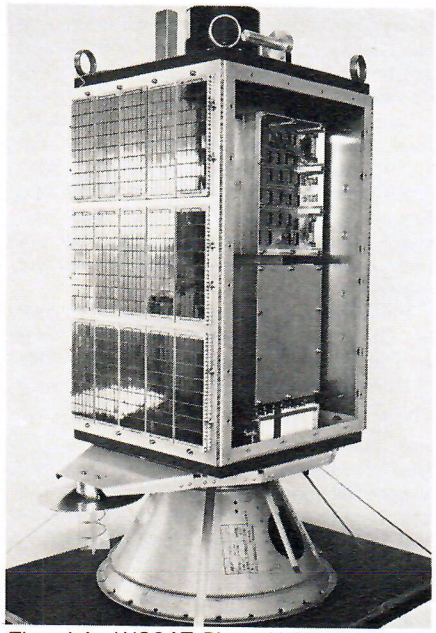
Please enclose a SAE or IRC when writing

ton payload in Earth orbit. Research on the project is due to begin this year and will run until the mid 1990s. The launch capacity of this giant rocket will be comparable to that of the American Space Shuttle and a new rocket being developed in Europe.

University's second satellite

UOSAT-B, the University of Surrey's second satellite, was successfully launched on March 1st by an American Delta rocket. Surrey is the first university to build a satellite from top to bottom, and they only had a matter of a few months in which to do it. NASA offered the university a free piggy-back launch, so the satellite had to be ready on time or it would miss this free-ride launch offer.

Normally, satellite design and construction is prohibitively high for universities – around £5 million. However, Surrey's team, led by Dr



The original UOSAT. Photo: University of Surrey.

Martin Sweeting, has sought alternative and more economical materials to use instead of the ultra-expensive space-qualified materials normally used, cutting the cost of the project to around £300 000.

UOSAT-B carries a number of experiments designed to stimulate experimentation by ground-based observers, especially in schools and colleges. Like its predecessor, UOSAT-B carries a speech synthesiser that will actually talk to you, if you have a suitable receiver. This model has a 500 word vocabulary, compared to UOSAT-A's 100 words.

British astronauts announced

The first four contenders for a place as the first British passenger on the Space Shuttle have been announced. They are Naval Commander Peter Longhurst, Lt col Anthony Boyle, Squadron leader Nigel Wood and civil servant Christopher Holmes. The decision on who will fly as a payload specialist aboard the American Space Shuttle will be taken by Defence Secretary Michael Heseltine.

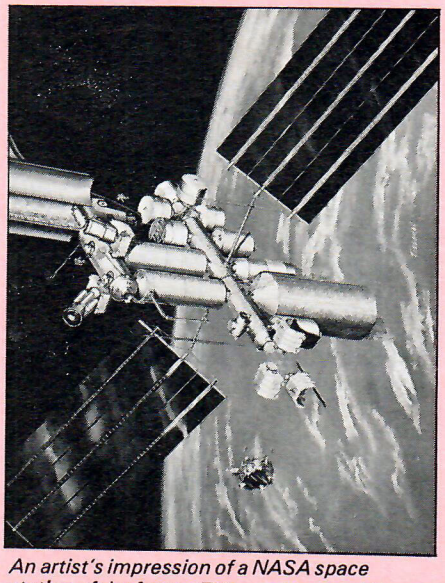
NASA NEWS

American space station

Of course, the big news on the NASA front arises from President Reagan's budget proposals for the year beginning October 1st 1984. NASA's funds are to be increased overall by 4%, including initial funds for a permanently manned space station and a major new flight programme to expand Man's knowledge of the planet Mars.

The increase brings NASA's budget for fiscal year 1985 to 7,491 million dollars. Preliminary space station studies are expected to consume about 150 million dollars. In science and applications, the budget provides for continued progress on the Hubble space telescope, the Galileo mission to Jupiter and radar mapping of the planet Venus. A series of relatively low cost planetary observation probes will investigate the geological and climatic evolution of the planets.

3,600 million dollars will go to the Space Shuttle programme, to be spent on spacecraft production, operations and tracking and data acquisition support. This is actually a reduction of about 300 million dollars, but it does not indicate a slimming down of the Shuttle programme. On the contrary, flight activity is increasing. The reduction is made possible because of increased revenue from paying customers. Plans call for 11 Shuttle missions in fiscal year 1985 and 16 in the following year.



An artist's impression of a NASA space station of the future. This version would have a crew of 12. Photo: Martin Marietta

Other Shuttle related activities requiring funds from the current budget request include the second and third Spacelab missions, completion of the fourth Orbiter, Atlantis, and continued development of the US-Italian tethered satellite system to permit space experiments in regions remote from the Shuttle Orbiter. The budget also calls for the launch of the second and third Tracking and Data Relay Satellites (TDRS) to complete NASA's new spaceborne communications relay system.

Galileo complete

The probe spacecraft that will make the first entry into the atmosphere of an outer planet has undergone its final check-out. Galileo is currently the only remaining approved major-scale planetary programme. Launch is set for May 1986 with planet arrival in August 1988.

In addition to the probe, the Galileo project will send an orbiter spacecraft to circle Jupiter for 20 months and return 50 000 high resolution pictures. Meanwhile, the probe will enter the Jovian atmosphere at 115 000 miles per hour enduring deceleration forces of up to 350 times Earth's gravity. Its incandescent shock wave will be as bright as the Sun. It then will fly 400 miles down into the atmosphere, descending through the turbulent and brilliantly coloured cloud layers into the hot, dense regions below.

The five foot diameter craft, almost half of which is a heat shield, will radio information about Jupiter's atmosphere to the orbiter spacecraft flying a parallel path 120,000 miles above. When the heat shield has done its job, the craft will then float down suspended by a parachute.

During the 20-month life of the project, the orbiter will orbit Jupiter 11 times and will make a close fly-by (100 times closer than the Voyager spacecraft) of at least one Galilean (planet-sized) satellite on each orbit.

The probe, built by the Hughes Aircraft Co with a heat shield from General Electric, will be managed by NASA's Ames Research Centre in California, although overall control of the project rests with NASA's Jet Propulsion Laboratory, also in California.

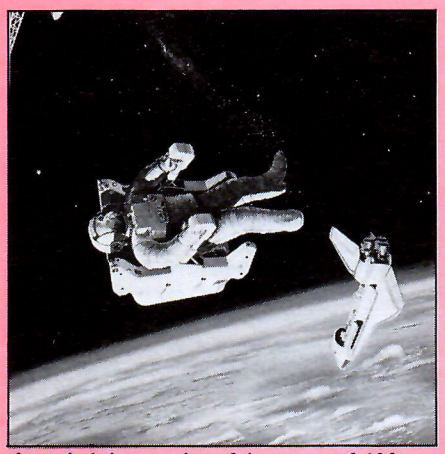
Backpack successful

Bruce McCandless became the first man to float free in space untethered to his spacecraft when he left the Space Shuttle during its tenth flight.

McCandless was wearing a multi-million dollar back-pack life support system fitted with a directional gas jet system – the Man

Manoeuvring Unit (MMU). The 24 nitrogen jets enabled him to manoeuvre precisely in space around the Space Shuttle Orbiter. He floated out to 320 feet away from the Orbiter.

Although, to television viewers on Earth, he appeared to be hanging stationary in space, he and the Orbiter were actually orbiting the Earth at over 17,000 miles per hour. His fellow crew member, Robert Stewart, also tried out the MMU during a second spacewalk, while commander Vance Brand stayed on the



An artist's impression of the successful Man Manoeuvring Unit (MMU). Photo: Martin Marietta

Orbiter's flight deck. The manoeuvres were a rehearsal for the next Shuttle mission, when astronauts will try to recover and repair a satellite in orbit. We will have to wait until *Voyager* August/September for an opportunity to report on that mission.

STS-10 was far from a success, though, because of the loss of two communications satellites launched from the Orbiter. Westar 6 was launched on February 4th and all appeared to go well. After launch, the satellite should have transmitted a signal to ground tracking stations, but it didn't. The loss is particularly gaulling to NASA because it won the launch contract by persuading the operator, Western Union, to switch to the Shuttle from Europe's Ariane rocket.

After a review of the situation, it appeared that the fault had been in the propulsion unit used to move the satellite into its high altitude orbit, and it was likely to have been a one-off problem with no bearing on the forthcoming second launch of the mission. The second launch went ahead, to place an Indonesian satellite, Palapa B2, in orbit. The same unhappy story unfolded and the satellite was lost.

Although the problem was not directly attributable to the Orbiter, which functioned perfectly, it casts a shadow over the Space Shuttle as a viable launch system as a whole. If the (probably) minor fault associated with the propulsion unit-satellite assembly cannot be identified and eliminated, it blights the whole system.

The satellites were reported to be part insured by Lloyd's of London, who will have to pay out around £70 million, half the value of the two satellites. Two such large losses so close together are bound to push up the insurance premiums that satellite operators must pay – currently £5-10 million.

An experiment to launch a balloon from Challenger also went wrong. The balloon was intended to mimic a satellite in orbit for safe location and manoeuvring experiments in preparation for the real thing on STS-11. However, the balloon appeared to burst shortly after its release from a canister in the Orbiter's payload bay. Not the happiest of Shuttle missions, but spectacular in what it did achieve – free flight outside a spacecraft for the first time.

Super volcanoes on Venus

Scientists believe that a massive volcanic eruption, dwarfing the largest terrestrial eruptions, recently occurred on Venus (in or before 1978).

Findings from Pioneer Venus in orbit around Venus point to the super-volcano theory. A five-year analysis of sulphur dioxide levels shows that they increased more than 50 times in 1978 and have been declining steadily ever since. On Earth, a major increase in atmospheric sulphur dioxide levels normally occurs after a volcanic eruption.

Earlier Pioneer maps show features that are the right size and shape for giant volcanoes. These areas have been found to be formed from new rock. Repeated clusters of lightning bolts occur in these areas – also in a similar manner to lightning behaviour on Earth. Measurements from a Soviet lander spacecraft support the detection of very young lava flows round these features.

Venus appears to have the same internal heat sources as the Earth. While the Earth can continually vent internal heat at many points, especially at the constantly expanding mid-ocean ridges, scientists believe that Venus does not have the same mobile plate tectonics as Earth and hence no mid-ocean spreading regions where the crust is forced apart and liquid magma emerges almost continuously.

How big are these super-volcanoes? Olympus Mons on Mars still holds the record for the highest volcano in the solar system – it's three times the height of anything found on Venus. But the Venusian volcanoes are much bigger in volume. The largest, Beta Regio, is 1300 miles in length, larger than the entire Hawaii midway chain.

The Soviet spacecraft, Venera 15 and 16, are currently mapping Venus, and preliminary results show volcanic cones. NASA is preparing a Venus Radar Mapper project, which will use radar with a higher resolution and covering five times the surface area of the Soviet spacecraft.

Comet encounter

Not Halley's comet this time. A scientific advisory group in the United States is urging NASA to support a project to rendezvous a spacecraft with a relatively bright, active short-period comet called Kopff.

NASA's Comet Rendezvous Science Working Group has selected this as the first of a series of missions to investigate primitive solar system bodies such as comets and asteroids, and later the far outer planets.

A rendezvous differs from a fly-by in that the spacecraft would match the speed and orbit of the comet and fly with it for several years. Kopff, which orbits the Sun every 6.5 years, will probably be accompanied through space by a Mariner Mark II spacecraft – the successor to the older Mariners, Rangers, Vikings and Voyagers. If the project is accepted, launch will be in July 1990 from a Space Shuttle, with rendezvous with comet Kopff in May 1999.

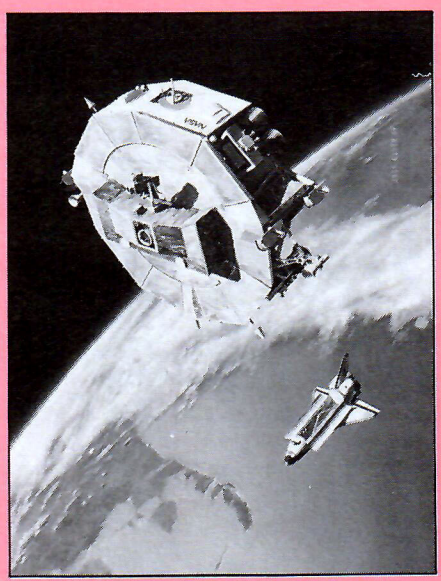
Smart space tug

Boeing Aerospace has bid for a major role in developing a smart space tug that would move satellites from place to place hundreds of miles above the Earth.

From all the proposals submitted for the Orbital Manoeuvring Vehicle (OMV), NASA will select three or more firms for 12-month definition studies to run parallel with each other. If the government decides to go ahead and develop an OMV, first launch should be around 1990. The Boeing team includes Rocketdyne (propulsion systems) and Aeritalia (soft-docking mechanism).

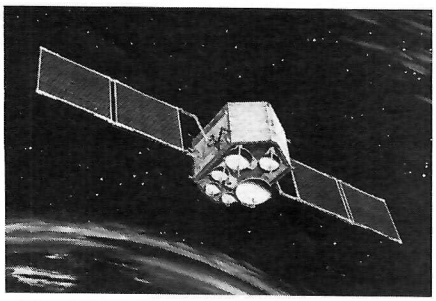
NASA's outline for the vehicle suggests that it will be an unmanned, Shuttle launched, re-usable upper stage about 15 feet in diameter and four feet in length, that would supplement the Space Shuttle. It will deliver and recover payloads to orbits out of reach of the Space Shuttle, up to 2000 nautical miles. It will also be capable of boosting existing satellites up to higher orbits as their existing orbits decay.

All flight operations except rendezvous and docking would be controlled by on-board equipment. Rendezvous and docking would be controlled from a ground station using television and radar systems. In the future, NASA envisages basing and operating the OMV from a space station.



An artist's impression of Boeing's Orbital Manoeuvring Vehicle (OMV). Photo: Boeing Aerospace Company

ESA NEWS



ESA's OTS-2. Photo: British Aerospace.

Orbital spot freed

The geostationary orbit is getting very crowded. It's the orbit in which satellites appear to remain stationary over one spot on the Earth's surface. In fact, the satellite is simply keeping pace with the Earth's rotation.

There are now so many satellites and chunks of unwanted space hardware in geostationary orbit that the risk of a collision between operational and de-activated satellites is increasing. In 1978 ESA launched a satellite called GEOS-2, which studied near Earth electric and magnetic fields. It had a lifetime of only two years. In January this year, the European Space Operations Centre (ESOC) in Darmstadt, West Germany, boosted the satellite into a higher orbit, where it will be no danger to spacecraft in the geostationary orbit c to those in transfer orbit (moving into geostationary orbit).

This is the first time that ESA has decommissioned and removed one of its satellites from geostationary orbit. In the near future, it will repeat the process with another ESA spacecraft, OTS-2.

Earth resources

The European Space Agency's first pre-operational remote-sensing satellite ERS-1 (Earth Resources Satellite) will be devoted to monitoring ice and coastal/ocean zones.

Part of ERS-1's instrument payload will take all-weather high resolution images of coastal zones, open oceans, ice areas and (experimentally) land surfaces. Instruments called scatterometers will measure wind fields and wave behaviour. The results from these instruments will be interpreted by comparing them to 'sea truth' data from similar instruments carried by a German scientific platform in the North Sea and an oceanographic vessel, supplied by CNEXO (Centre National d'Exploitation des Oceans), off the Brittany coast.

Several bodies and institutes in France, Germany, the UK, the Netherlands and Canada will participate in this experimental phase.

Twenty years in space

1984 marks 20 years of European co-operation in space. In 1964, the European Space Research Organisation (ESRO) and the European Launcher Development Organisation (ELDO) came into being. They were later re-organised and became the European Space Agency (ESA). These past two decades have seen 127 sounding rockets, 12 scientific spacecraft, five applications satellites, the European launcher Ariane and its payloads and the manned orbiting laboratory Spacelab all launched successfully as a result of European co-operation.

Successful Ariane V8

On March 4th this year at 21 hours 50 minutes 03 seconds (Kourou time), Ariane V8 lifted off from the Guiana Space Centre carrying an Intelsat V F8 satellite.

The stages and other systems of the European launch vehicle functioned correctly and the Intelsat communications satellite separated from the final stage as planned. Latest information from ESA is that the satellite is in an elliptical orbit ranging in altitude from 186 to 36 045 km, inclined at almost nine degrees to the equator.

From now on, Ariane launch activities will be carried out under the auspices of Arianespace, not ESA.

SOVIET NEWS

Salyut 7 visitors

On February 8th, the Soviet Union launched a Soyuz T-10 spacecraft carrying flight commander Leonid Kizim, flight engineer Vladimir Solovyov and cosmonaut researcher Oleg Atkov.

After an automatic approach, the spacecraft was manually docked with the Salyut 7 orbital station. The three cosmonauts passed from their Soyuz T-10 into Salyut 7 to begin their work programme including studies of the Earth's surface and atmosphere, and medical/biological research. The crew also installed a new purification block in the system that recovers water from atmospheric moisture, replaced several fans and checked out the system that control's the space station's orientation.

The mission's commander, Leonid Kizim, is a 42-year old Ukrainian. His first space assignment was as commander of the Soyuz T-3 spacecraft and Salyut 6 orbiting station in 1980. Oleg Atkov, 35, is an accomplished medical researcher specialising in cardiology. He began training for spaceflight in 1977. Vladimir Solovyov, 37, joined the cosmonaut unit for training in 1978. He has been working on the design of new space technology.

Salyut 7 has been in orbit since April 19th 1982. Two crews have worked on-board the station on long duration missions lasting 210 and 150 days respectively. There have also been two visiting crews.

Gagarin chief comments

In an interview with the Tass news agency, Georgy Beregovoi, chief of the Yuri Gagarin Cosmonauts' Training Centre, said, 'The development and deployment of permanent orbital complexes with rotating crews is the main line of development of Soviet cosmonautics.'

He continued, 'We are interested in the conduct of the human organism at all stages of an orbital flight. It is important to us to have objective scientific data, in particular, about the reactions of the heart and the circulatory system to weightlessness.' Hence the inclusion of a physician in the latest Salyut 7 crew.

'Yuri Gagarin dreamed that specialists of different trades will work in space. Today this dream is coming true.'

Raduga relay satellite

On February 15th, the Soviet Union launched a Raduga communications satellite. Its job is to ensure telephone and telegraph communication and transmission of television programmes. It has been parked in a circular, nearly stationary orbit at an altitude of almost 36 000 km. The satellite appears to be functioning normally.

Permanent space station

A recently released commentary outlines Soviet plans for future space station operations.

The commentary, released in the UK by the Novosti Press Agency, reveals Soviet plans to switch from long-term orbital stations periodically visited by crews replacing each other, to a multi-sectional, permanently inhabited orbital complex.

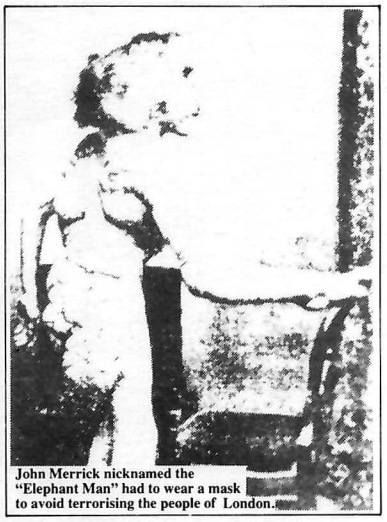
Such a complex is envisaged as a single system of large structures placed in orbits at an altitude from 200 km to 40 000 km and linked with Earth by means of transport cargo-passenger space ships. The complex would contain research labs, living modules, energy plants, a refuelling station, repair workshops and construction platforms for manufacturing more structural elements. Benefits of such a large permanently manned station would include uninterrupted atmospheric monitoring, agricultural crop observations, forest fire spotting and mineral deposit location. Ship and aircraft positions could also be continually monitored and industrial processes could produce electronic, optical and medico-biological materials with characteristics unattainable on Earth.

UNBELIEVABLE!

P.T.Barnum and General Tom Thumb. The midget who weighed 15lbs and was 25 inches tall, made millions for Barnum.

That's the only way to describe this amazing new collectors edition of human oddities

VERY SPECIAL PEOPLE



John Merrick nicknamed the "Elephant Man" had to wear a mask to avoid terrorising the people of London.

This just published volume is a handsome and tastefully produced volume of the most amazing sideshow personalities of all time. It is by far the greatest, the most complete work of it's type ever compiled.

The Tocci Brothers were two boys down to the sixth rib, but only one below.

Guaranteed to fascinate

These are just a few of the many "mistakes of nature" included in Frederick Drimmer's fascinating new book, **VERY SPECIAL PEOPLE**. What makes them very special is that they were all born "curiosities" and they all lived unusual lives.

Personal Stories

Like Chang and Eng, **the original Siamese twins**, who were joined at the chest for life. They married sisters, set up separate homes, and fathered 22 children between them!

Then there was Grace McDaniels, who was billed as **the ugliest woman** who ever lived (and her photo proves it). Believe it or not, Grace received several proposals of marriage before she accepted one from a handsome young man. They had a perfectly normal son, who grew up to be his mother's manager!

John Merrick, the grossly deformed **"Elephant Man"**, was deserted by his heartless manager. Befriended by a kindly doctor, Merrick became quite famous and was frequentiy visited by Royalty.

Seeing is Believing

All the stories in this book are true, and we have over **65 rare photographs** to prove it. Never has one book been so complete. There are chapters on giants, dwarfs, fat people, armless and legless wonders, hermaphrodites (half man, half woman), bearded ladies, and numerous other human oddities.

"Freaks" no more

This is not just a picture book of "freaks". The author treats these people with insight, compassion and the dignity one earns by being born different from everyone else.

VERY SPECIAL PEOPLE will also teach you one of the most important lessons that life has to offer: the incredible ability of man's mind, soul and spirit to overcome any physical imperfection ... no matter how hopeless it may appear.

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- Falia, "The Ugliest Woman to Ever Live"
- Lionel the "Lion Faced Man"
- Krao, "Darwins Missing Link"
- W.T. Sapp "The Stone Man"
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Julia Pastrana (1832-1860) was to ugliness what Marilyn Monroe was to loveliness.

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TO BOLDLY GO...

Simon Goodall has come with another of his specialist brain stretchers – this time the subject is Star Trek. Answers on page 74. If you attempt to cheat, this magazine will self-destruct in five seconds!

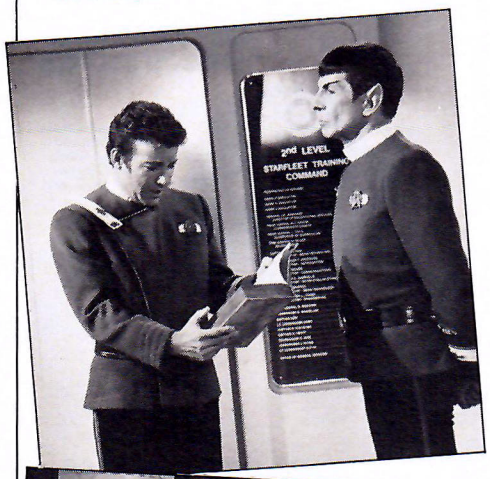
Briefing

You, as Commander of the Constitution II Heavy Cruiser Starship USS Valiant – NCC 1709 have been ordered by Star Fleet Command, as of Stardate 8142.6 to proceed with all haste to the Tholian Star System on an important mission. In order to reach your destination you must answer all the following questions, based on the fictional world of Star Trek, correctly. For each question you are awarded a number of Parsecs (1 = 3.26 Light Years). The more questions you answer correctly the closer you come to completing your mission.

Mission

A Star Fleet Monitoring Station has picked up an emergency SOS signal from the Tug/Transporter USS Copernicus – NCC 3185. She is, at present, orbiting a moon in the Tholian System near the Organian Treaty Zone. She has lost all power except life-support and her orbit is decaying rapidly. A Klingon Cruiser has intercepted her signals and is on an attack course for the stricken vessel. USS Valiant must recover ship and crew before the Klingon warship comes within firing range.

The distance between your Vessel and Copernicus is;
52 Parsecs (169.52 Light Years)
Good Luck!



From construction to re-furbishment

1. In which century does Star Trek – The Motion Picture take place?
(1 Parsec)
2. How many Klingon ships are destroyed in the opening sequence of this film?
(1 Parsec)
3. What piece of Star Fleet hardware is destroyed by the mysterious cloud?
(1 Parsec)
4. Who *was* to have commanded the new USS Enterprise?
(1 Parsec)
5. What Earthbound position has James T Kirk held for the past two and a half years?
(2 Parsecs)
6. How many years of its original five year mission did the Enterprise complete?
(2 Parsecs)
7. How does the Ilia probe refer to Humans?
(2 Parsecs)
8. For such a sophisticated entity, V'ger said Hello in an ancient way. What was it?
(3 Parsecs)
9. In the beginning, the United Federation of Planets consisted of only five. Can you name the Systems?
(5 Parsecs)
10. Although Enterprise is the most famous ship in Star Fleet 13 other sister ships were built at the same time. Name six.
(6 Parsecs)
TOTAL: 24 Parsecs

Star Trek II – The Wrath of Kahn

1. Who is Captain of the *simulated* Enterprise?
(1 Parsec)
2. What is Dr Macoy's antique birthday present to Jim Kirk?
(1 Parsec)
3. On which planet did Captain Terrel and Chekov have a nasty surprise?
(1 Parsec)
4. Who is Ditector of Project Genesis on Regula 1?
(1 Parsec)
5. Name the global conflict with which Kahn was strongly associated.
(2 Parsecs)
6. Kirk may be commanding a Starship but where did he 'leave his heart'?
(3 Parsecs)
7. Where is 'Sauce for the Goose, sauce for the Gander'?
(4 Parsecs)
8. A series of numbers has disasterous consequences for Kahn and the USS Reliant. What is the series of numbers called?
(4 Parsecs)
9. The Kobayashi Maru is impossible? Not for Kirk.
Why?
(5 Parsecs)
10. Spock sees his heroic sacrifice as logical.
In what way?
(6 Parsecs)
TOTAL 28 Parsecs

GRAND TOTAL 52 Parsecs

MODEL ROCKETRY

PETER FREEBREY CONTINUES HIS REPORT ON THE WORLD OF PINT-SIZED PYROTECHNICS AND THE PEOPLE WHO CONTROL THEM

Space modelling, like any other sport, has to operate within a fixed set of rules and regulations. Firstly, we have a set of *safety rules*, which vary slightly from country to country, but roughly follow those published in the last issue of *Space Voyager*. These rules are followed quite rigidly at *all* times regardless of whether you are flying for fun or striving to win a 'gold' at the World Championships. From this base of safety rules the sports flier need not really concern himself with much more, although occasionally there may be a local rule (club rule) restricting certain types of engine or model from a particular location. This is usually only to the flier's benefit as it would be perfectly feasible to fly a streamer duration model from a small field the size of a football pitch, but a parachute duration model or a boost glider could easily be lost. It would also be a bit pointless to use a large engine in a high flying model in similar circumstances. Often the newcomer to space modelling feels that the *big* way to go is to get his/her model to go higher and higher . . . fine, but even with 20-20 vision these 'star grabbing' heights cannot often be seen.

Top left, wizard like character caught in the middle of a high-tec incantation is content director at an international 'meet' in Czechoslovakia. Top right, Mercury Redstone scale model by Milan Radic (Yugoslavia). Bottom right, Czech boost-glider prepared for launch. . .

Back to the rules

You can have great fun flying sports models, but, when several modellers get together, sooner or later one is going to try and fly longer, higher or further than the others – competition! For all those taking part, whether at club, national, continental or world championship level, there has to be a framework of rules that gives everyone an equal chance at the start – it's no good having an altitude competition if you have a motor only one tenth as powerful as those of other competitors.

Space modelling has many different competition classes and each of these classes (parachute duration, streamer duration, altitude, etc) is divided into a number of subclasses dependent upon motor size. Each

The author with canard parasite boost-glider at European Champs. This type of B/G is easier to trim under rocket power but being quite small it is much more difficult to see in the air!

country has its own set of national rules for competitions. These are determined by that country's governing body – the National Association of Rocketry in America, the Canadian Association of Rocketry in Canada and when this country becomes more competition orientated – the British Space Modelling Association. Although each country has its own published set of rules, many of these are similar from country to country. This is because each country that has a keen following for Space Modelling belongs, through their National Aero Clubs, to the Fédération Aéronautique International (FAI). This is the international body that authorises and records all international aerospace competitions and records, be it the World Gliding Championships in Australia, the number of times an astronaut circles the Earth in a satellite or the record height achieved by a space model. The delegates from the various national space modelling associations meet under the watchful eye of the FAI and determine those rules that are to be used for international meetings.

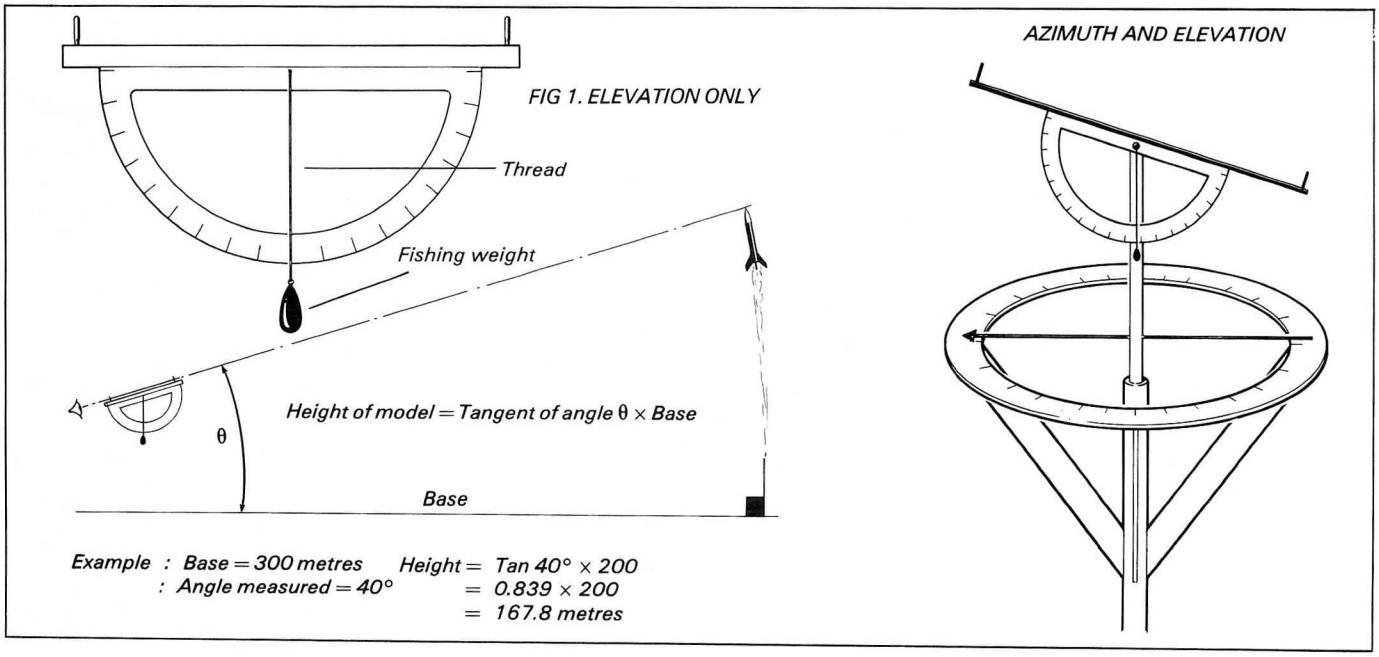
The FAI does not accept every type of space modelling competition for international recognition, so on a national or club level there is plenty of scope for the introduction of all sorts of interesting, thought provoking or pure fun competitions. For example, the FAI recognises eight main classes of competition

- S1 – Altitude • S2 – Payload
- S3 – Parachute Duration
- S4 – Boost/Glider • S5 – Scale Altitude
- S6 – Streamer Duration
- S7 – Scale • S8 – Rocket/Glider

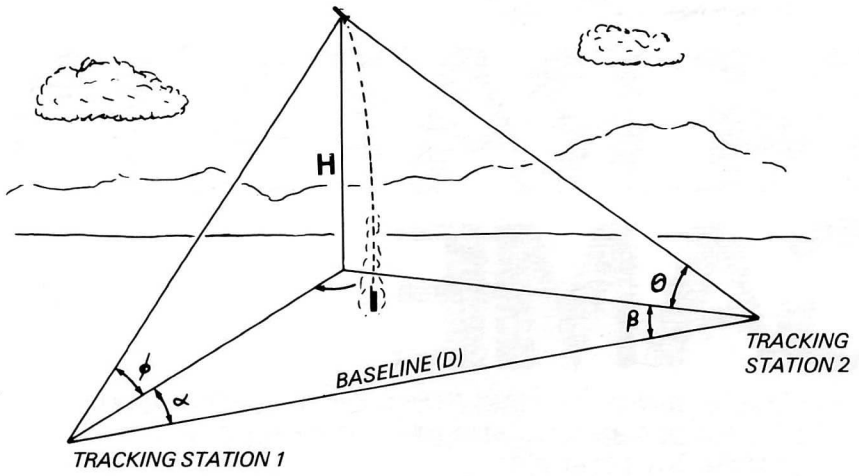
On the other hand, the National Association of Rocketry (NAR) in America has over 30 different classes! Also, bear in mind that most of these classes are again subdivided into different sub-classes according to motor size.

Motorised screaming eagles!

The newcomer nearly always looks through a catalogue and *zeros in* on something like the *Kadet* or *Screaming Eagle*. Both claim over 1000 feet high flights, are easy to build and will take a range of motors. Over 1000 feet is quite easy to get with a model rocket, but even when a streamer with a length of several feet is



ALTITUDE DETERMINATION USING TWO TRACKING STATIONS



CALCULATION

D = length of baseline in metres

let $\gamma = 180° - (\alpha+\beta)$

let $A = \sin\beta \cdot \frac{D}{\sin\gamma}$

let $\beta = \sin\alpha \cdot \frac{D}{\sin\gamma}$

$\therefore H_1 = A.\tan\Phi$ *metres*

and $H_2 = B.\tan\theta$ *metres*

Average altitude $= \frac{H_1 + H_2}{2} = \ldots$ *metres*

ejected, if you don't know where to look it can be all too easy to loose! Start with a lower power motor so that you can get used to tracking your *bird*; remember that these models are very light (1-2 oz is normal) and they accelerate *very* fast. Using a parachute can make them easier to spot but even a small parachute with such a light model can easily be picked up by a thermal and will travel a long way across the ground from 1000 feet up! Again use the smaller motors.

Both parachute and streamer retrieval are substitutes for measuring altitude – streamer especially. A streamer is less effected by thermals (rising currents of warmer air) and timing a model from lift-off to landing can be an easy way of comparing the altitude attained by two different models (using the same size streamer, of course!). It is possible to get a fairly accurate measurement of altitude using a simple tracking device made from a school protractor (fig 1). Using this and a simple calculation, it is possible to get an estimate of the rocket's altitude, providing that the flight is pretty well vertical. To get a more accurate measurement, two of these sighting devices are needed and a *slightly* more complicated calculation (fig 2). Another simple altitude determination method is to eject a standard length streamer with a small weight (5 gm) attached to one end – time the streamer from ejection to landing – crude but better than timing the entire model from lift-off to ground.

Having got a method for finding the altitude achieved you can then apply this to many of the *altitude* type of classes. These are often favoured as, with streamer recovery, you don't need a large open space in which to fly. Although, even with altitude events a parachute is sometimes sensible, for instance in Payload or Eggloft. Payload requires the model to lift a lead disc (or discs) of 19.1 mm (±0.1 mm) weighing 28 grams and for safety reasons a small parachute is required. Eggloft has a payload of one fresh (!) hen's egg (Ed – eggstraterrestrial?) – uncooked – and must be recovered intact. The fresh egg is intended to simulate an astronaut and must be properly cushioned and restrained to withstand the forces of acceleration and the shock of landing. As no score is recorded if the egg is damaged (Ed – eggsasperating!), a parachute is a must!

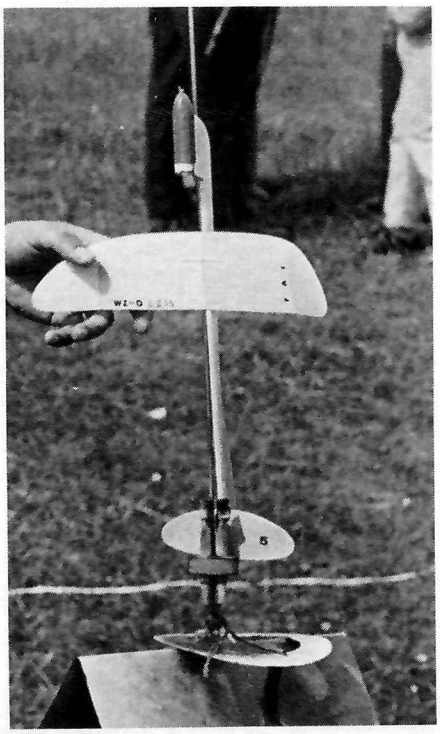
Boost-glide systems

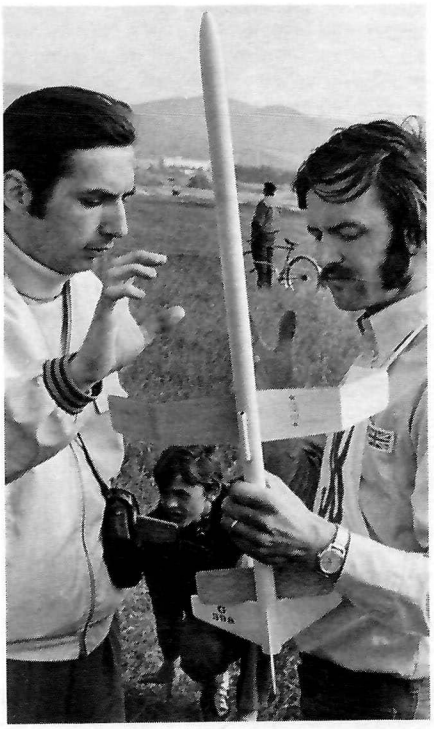
Duration competitions only require a stopwatch to determine a result. These can vary from the simple parachute duration type to the more complex boost/rocket glider types. Boost glider (B/G) is probably the easier to attempt of these latter two classes. The B/G rules permit the ejection of the rocket motor and its mounting to enable the glider portion to continue on its way unhindered (rocket gliders are not permitted to eject or release any part of the model). This means that the boost phase is relatively easy to control. Two simple methods are shown in the photos below a straightforward glider with the rocket pod mounted well forward of the wings. Roughly, the further forward, the less effect the wings will have on the powered flight pattern – it will go up as a rocket *not* as a powered aeroplane. The second method shown, looks like a standard rocket but a small (parasite) glider is attached at the rear end – with enough weight in the nose, the combination will again ascend as a rocket, releasing the glider portion when ejection occurs.

One space modelling book is well worth reading. I have not seen it in bookshops in this country but that surely will not deter the keen space modeller! It is – *Handbook of Model Rocketry* by G Harry Stine, published by Follet Publishing Company of Chicago – USA.

To learn more about space modelling in the UK write to the British Space Modelling Association, 15 High Street, Ditchling, Sussex BN6 8SY – please enclose an SAE.

Left, conventional boost glider with motor mounted well forward of the wings (latest designs have the motor even further forward). Right, another example of parasite B/G, John Wheddon (G.B.) flies conventional layout gliders 'tacked' onto straightforward space model.





THE REGENERATION GAME

AMID REHEARSALS FOR THE NEXT SERIES, WENDY GRAHAM TRACKED DOWN COLIN BAKER, HIS FELLOW TIMER TRAVELLER, NICOLA BRYANT, AND DR WHO PRODUCER, JOHN NATHAN-TURNER

Colin Baker has always been an SF fan, with a vast collection of books and tapes, and his Who watching goes back to the first episode. Now he is relishing the fact that he can roar with obvious delight 'I AM THE DOCTOR' to the world. Colin's Doctor is going to try to re-capture the wonder of it all, and the doctor's alienness.

'He will be insatiably curious, intolerant, waspish, and kind but cruel. Many times he won't react with the emotions expected.'

In preparation for his role, Colin brushed up his already extensive knowledge of Dr Who by watching more than 200 hours of tapes. When I spoke to him, Colin had already filmed his regeneration and would be going into studio the next day to start recording his first full story.

'I've already found that, like all SF TV, Dr Who is good fun off stage, very light hearted.'

'Most of the work an actor does tends to be bread and butter, not Hamlet. This combines the best of working as it is so creative.'

'As an actor it is marvellous in another way too, for every story has a new cast of guest stars. And, of course as a devotee of Dr Who, what could be better for me? A fair few years employment in a role which goes round the world and which I've always wanted to do. Wonderful!'

'It was exciting to get the role, not daunting. It's not like playing Hamlet. I used to get recognised from my time in *The Brothers* sometimes, but right from the announcement in August people have been recognising me as the Doctor, and I'm fully aware that I'm going to be unable to go anywhere without being looked at from now on' – this said with such a grin that you know he is going to enjoy every minute of that. But isn't it surprising for an actor best known for his playing of the bad guys to get picked as Dr Who, I asked?

'As a rule the baddies are the more interesting parts. The Doctor is the great exception to that. He is a hero but not in the bland mould. Baddies generally are best because the writers have found it more interesting to write about people who break the rules, but the Doctor makes and breaks his own rules. He is a galactic buccaneer. Neither good nor bad. A bit of a meddler.'

On his multi-hued costume Colin commented 'Well, yes it would seem that the Doctor now has appallingly bad taste. The costume was John's idea mainly, but after the shock of first seeing it, it is now growing on me.'

After completing work on his first episodes Colin was going to a *baptism by fire* Who convention in Miami. Then at the end of April he was going back to Sweden to appear in Theatre before returning to work on the 1985 series.

Final comments? 'I'm going to have a smashing time and I'm going to have a long run!'

Peri's plum

Acting is not the most secure profession, with a high percentage of members at one time or another *resting*. So, it is that much more of a wonder for a 22-year-old actress ten days out of drama school, with no agent, to be handed one of the year's plum parts. The part is the tongue-twistingly titled Perpugilliam Brown (henceforth to be known as Peri) and the actress is Nicola Bryant, still refreshingly amazed at her good fortune.

'I'd just left school, no Equity card, and had been round to see several agents. One suggested I audition for the part of the Doctor's new companion. I thought that the experience of the audition would be good, and I would meet some BBC people which would be useful.'

'Then I got called back, and waited and called and waited I didn't hear for about three weeks. Getting this is such a gift at the start of a career. My main difficulty is that at drama school (Webber Douglas) they teach you nearly all about stage work, so here I am and about all I know of the techniques of TV work is that studios have cameras. I'm learning very, very fast.'

Her task has not been made easier by the fact that no sooner did she join the series than the Doctor promptly regenerated into Colin Baker.

'We haven't yet stabilised our relationship, but with the break in production coming we have time for it to be worked through. Peri is a botany student. She's restless and has never had a father figure, which is why she joins up with the Doctor.'

'Peri will grow up as the stories go on. I've felt from the beginning that the part was well written, and, as she has an established past I've been able to build on that, and to mould onto what has been written to flesh out the character. She is half American, and I have dual nationality. I've lived in New York, New England and Virginia, so there is some of her in me, but not that much.

'People seem to think of Americans as strong characters, though, and the first thing I do when I get my script is cross out the *Peri Screams* whenever I can, though I guess they'll have to stay for each episode's cliffhanger ending.

'When I was younger I used to watch Dr Who a lot, I mostly remember watching Jon Pertwee.' Now the youngster who was frightened of the Daleks is looking forward to going to conventions and being recognised in the street.

'I went to the con' in Chicago last November and thought the enthusiasm over there quite touching. Now I'm looking forward to going to British conventions. I've already got some fan mail from over here and from the USA and I'll try to reply to as many letters as I can.'

Nicola has already signed to do the next season, but counts among her long term ambitions a desire to use her drama school training on stage, to continue with her music writing and piano playing and to work in the States.

'But isn't this a great vehicle to launch a career?'

Hell for leather production

The BBC's Union House, just a stone's throw from the TV theatre is an undistinguished building from the outside, and pretty much the same from the inside. There's nothing much to show that many programmes have their production offices behind featureless and numbered doors, until you reach a couple of offices on the second floor, with doors decorated with all sorts of Dr Who posters and stickers. Inside, just about every inch of available space is covered with Dr Who memorabilia and trivia.

Producer John Nathan Turner's office is even more decorated. Video tapes line the windowsill, there are all the Who books, Who cushions for the chairs, fan artwork, a whole wall of photos of actors and actresses and on a shelf by his desk the tiny figures of characters used in *The Five Doctors*.

Dotted on top of all these are some of the hundreds of birthday cards received by the programme last November. Squeezed into this cleaner's nightmare is a desk and it is from here that John controls world *Whoism*.

Enthusiastic and full of bounce, John took some time out from production of Colin Baker's first episodes to chat about his role as producer of one the BBC's most successful programmes.

'It's not like producing any other programme' he said. 'It is really hell for leather for 52 weeks a year. First and foremost we have to make the programmes, obviously, but then there are all the peripheral activities – conventions, keeping in touch with all the fans who write in, and merchandising.'

'As producer of the programme I am effectively custodian of the BBC's copyright on Who, and check all merchandising ideas very carefully.'

'I have to protect the show and the fans. For example, a manufacturer wanted to make Who darts. I felt that with their sharp points they wouldn't be safe in the hands of some of the younger fans and said no.'

'The BBC has a merchandising department, but they can't be as astute as we can over errors or bad taste as it applies to Who.'

John is committed to producing Who for at least another season before he again takes stock of whether it is time for him to move on. He is already the programme's longest serving producer.

'I've always tried to make good programmes' he said. 'I wanted to do Who very very much before I got the job – my own ego wouldn't allow me to work on a one million audience BBC2 programme.'

'But the time comes for a new producer with new ideas. I've been very lucky to work with three of the six Doctors – Tom Baker, Peter Davison and now with Colin. It has been all change this season with a new Doctor and a new companion.'

'And I have to bow respectfully to whoever thought up the idea of regeneration for the Doctor.'

But what about rumours of a new look for the Tardis as well? No decision yet. 'But it is one of the things we're looking at . . . .'

There have been other rumours about Dr Who recently. Both of which John quashed firmly. 'No, the show is not about to be axed. In pure financial terms it is far too successful, and No, Brian Blessed was never considered by me for the part of the Doctor. Brian is a wonderful actor, but I never ever saw him as the doctor. He never was considered. I know where the rumour started' he added.

'Choosing the Doctor is not easy. Every actor has injected a tremendous amount of their own personality into the role. I know Peter has been criticised for the way he played it, but I wanted a preppy hero image. We had to find something which would make a strong contrast to Tom's Doctor. Tom made a vital contribution to the show and opened up the USA for us.

'We will now have another completely opposite image for Colin's Doctor.'

John has been criticised for seeming to pay more attention to American fans but he counters by affirming that it is the attention from still-new American fans which helps to assure the future of the show – and they invite him to cons.

'Many times I simply don't get asked to cons in Britain, more's the pity. I feel that there ought to be more fan activity. If I could get away I would go to a convention with only 200 fans. I work for the BBC after all, and making the programme must always come first. But please ask me.'

'Wherever I go I try to be an ambassador for the show, and to encourage foreign sales. I'm going to Australia at the end of May for a holiday and while there I'll probably do some book signing and so on, for example.'

'I have a tremendous respect for the fans, though you can't allow them to dictate. They can't rule the whole thing.'

Many fans send in ideas or scripts for the show. Do they have any chance of success?

'Well, yes, though it is very remote. One writer, Andrew Smith sent in many ideas and finally we asked him to write a script, which he did, working very closely with the script editor. Since then Andrew Smith has also written for *Not the 9'O'Clock News* and *A Kick Up the Eighties,* and we have one or two other promising writers who we keep an eye on, but changes are slim. If fans do want to send in ideas they should only send outlines – just a few pages, not complete scripts for four episodes.

'And fans can certainly also help the show by continuing to keep a lookout for the lost early episodes. I personally guarantee no questions asked about where they came from. We've even found a colour version of a Patrick Troughton story which we only had in Black and White.'

Finally, the BBC received massive criticism from fans about the Longleat Birthday celebration.

"Yes there were a lot of things wrong. They just massively underestimated the interest. They showed me the plans and the space they had planned was about a quarter of the final size. I persuaded them to expand it three or four times, then they called a halt to that because it couldn't be roped off any more. I thought the content of the show was very very good indeed. I would like to see it done again and get it right. We all learned a lot.'

Back to back with producer John Nathan-Turner, the new Doctor Who – Colin Baker. Photo: © BBC 1983

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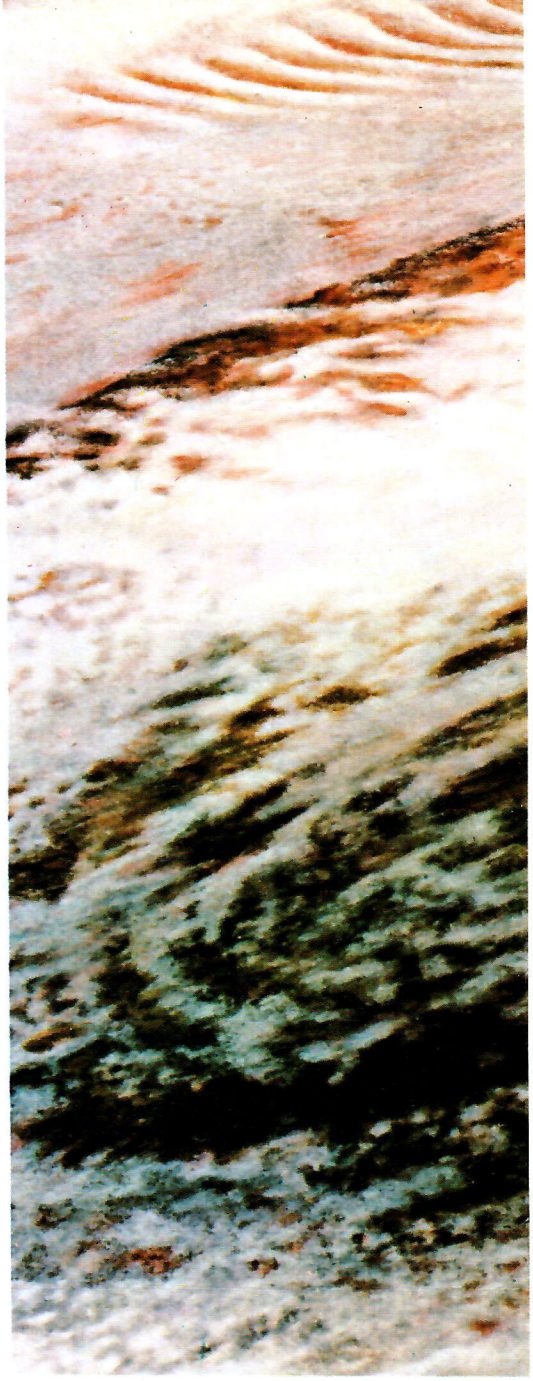
MARS -A RUSTY PLANET

CONWAY SNYDER, A VIKING PROJECT SCIENTIST FROM CALIFORNIA'S JET PROPULSION LABORATORY, LOOKS AT MARS THROUGH THE 'EYES AND EARS' OF THE VIKING SPACECRAFT.



The exploration of Mars began with the acquisition of 22 not-very-clear pictures of the surface and some scientific measurements by the American spacecraft Mariner 4 in 1964, and was continued with much more extensive observations by Mariners 6 and 7 in 1969. By a strange perversity of luck, however, these three missions managed to miss many interesting locations, and it remained for the Mariner 9 orbiter in 1971 and the two Viking missions, each with an orbiting spacecraft and a lander, to fill in more details.

The Viking spacecraft were launched in 1975, each consisting of a lander capsule and a solar-powered 'bus' to carry the capsule into orbit around Mars and release it on a trajectory to bring it to the surface at a preselected landing site. The first landing occurred on July 20, 1976 and Lander 2 touched down on September 3.

There are three major problems for terrestrial life forms anywhere on Mars – the cold, the dryness, and the thinness of the atmosphere. What little atmosphere exists is mostly carbon dioxide.

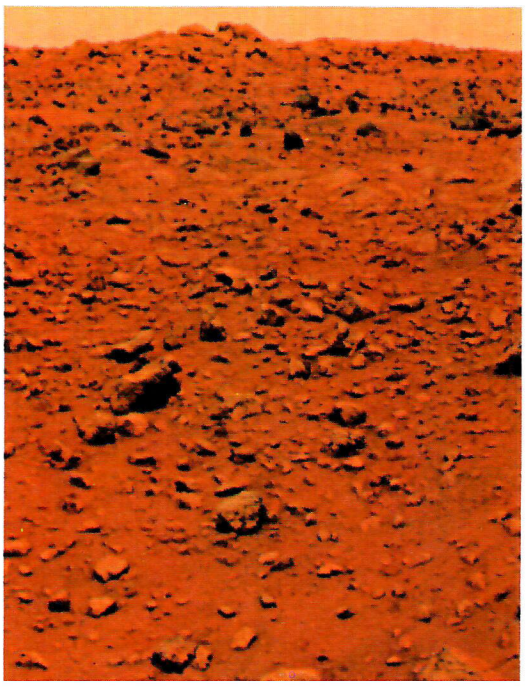
Mars is cold because it receives only half as much sunlight as Earth, and its thin atmosphere is not very efficient at trapping what heat does fall on the surface. Probably no place on the planet ever experiences an atmospheric temperature higher than 20 below zero Centigrade. The highest temperature ever recorded was 40°C.

With temperatures always below freezing, liquid water is non-existent. Large but unknown quantities of ice occur in the polar caps and probably under the surface at lower latitudes where it cannot be observed directly. Although it may often be nearly or completely saturated with water vapour, the very cold atmosphere cannot hold much water. The largest quantity observed would make an ice layer less than 0.1 mm thick if it were all to condense on the surface.

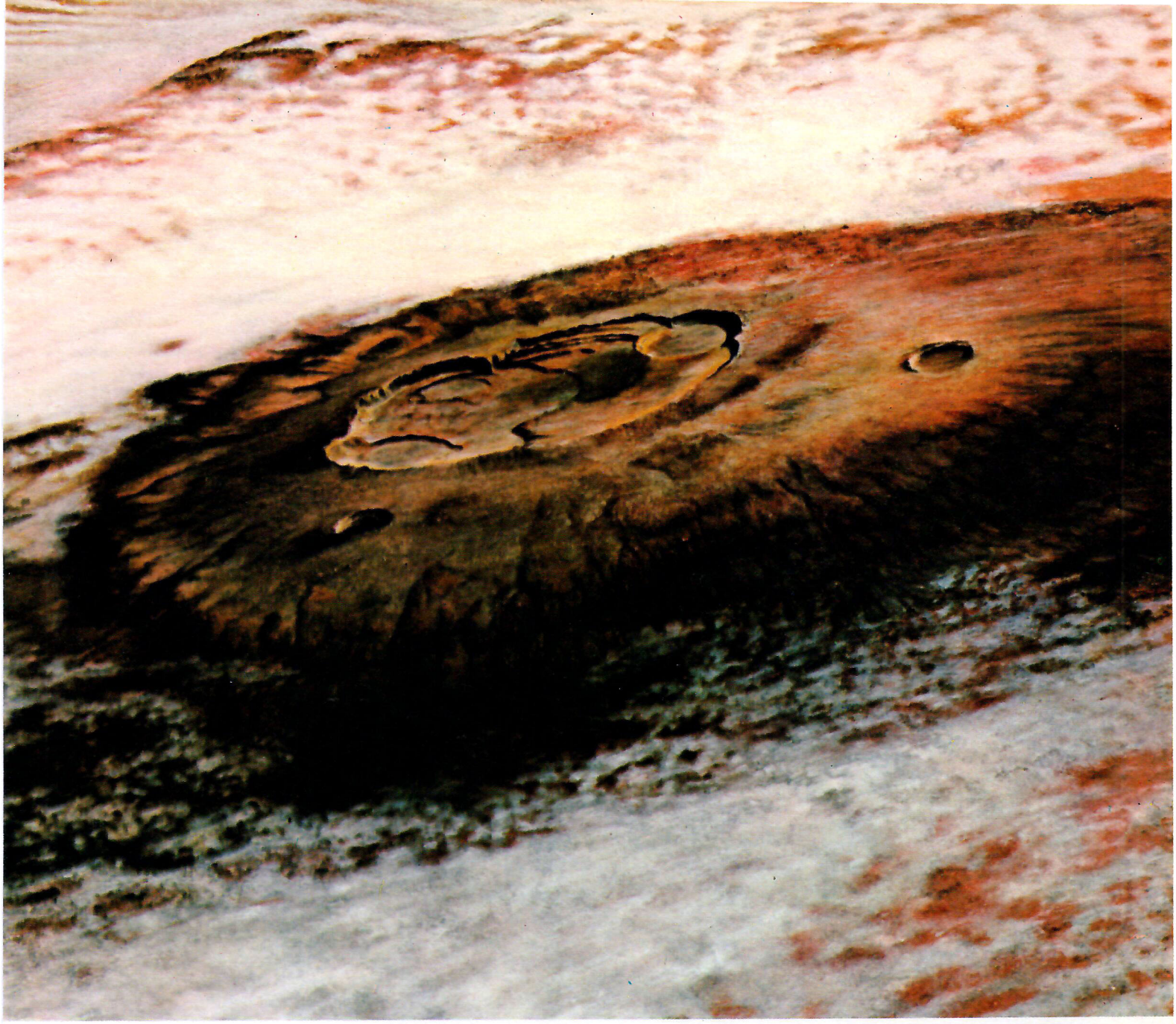
The highest atmospheric pressure observed by either Viking lander was about 10 millibars, barely 1% of sea-level pressure on Earth. During most of the year the pressure is still lower and in the late summer in the northern hemisphere it reaches a minimum. Nearly a third of the carbon dioxide freezes out on the surface around the south pole during its long winter night.

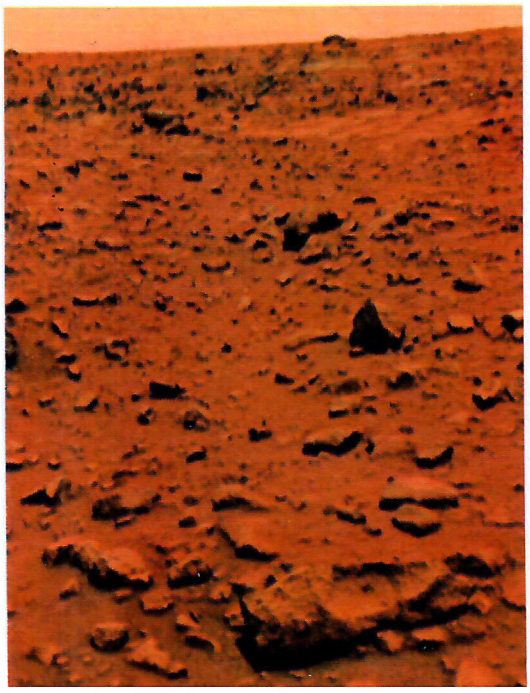
A room with a view

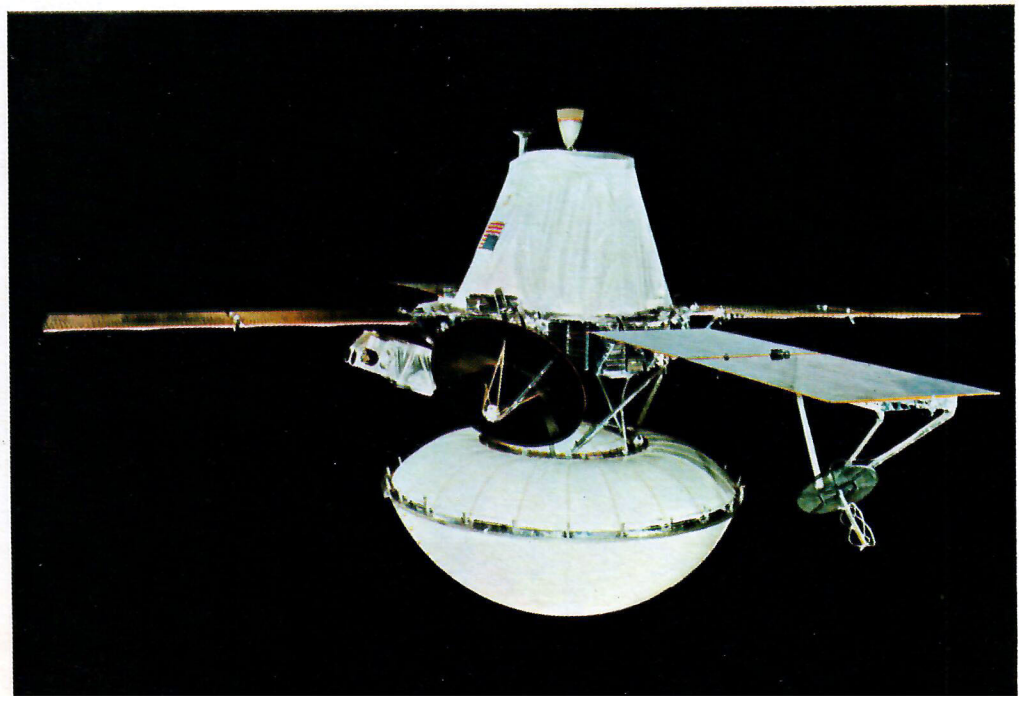
If we had to pick a place to live on Mars, we could probably not do much better than the lowest point in Chryse Planitia, about 200 km from Viking Lander 1. The low elevation (between 3 and 4 km below the mean Martian surface) would provide some advantage in slightly higher atmospheric pressures and temperatures. At this latitude, 22 degrees north, the weather is about as warm as anywhere for most of the year and the winds are very calm in summer and always moderate. The most unpleasant time of year will be midwinter, when planet-wide clouds of dust



Above: This hand-coloured picture of Olympus Mons was made from a mosaic of Viking orbiter 1 pictures taken in July 1976 from a distance of 8000 km. As is common in the morning in the summer season, the mountain is wreathed in clouds with only the peak showing through. Below left: This view to the south of Viking Lander 1 was taken on July 21st, 1976, the first day after the first successful landing on the planet Mars. The location is 22.3°N, 48.0°W in Chryse Planitia. Below right: A Viking spacecraft as it appeared in space on its cruise from Earth to Mars. The lander is enclosed in a biological shield to prevent contamination and an aeroshell for protection. Photos: NASA.







may blot out the Sun completely for several score of days, resulting in temperatures as low as −89°C at dawn and −75°C at midday. The mean length of a Mars day is 24 hours, 39 minutes, 35 seconds.

Frosty phenomena

Two meteorological phenomena are observed in northern latitudes that do not occur at more temperate latitudes. A thin layer of white frost deposits on the ground in the late autumn and remains for much of the winter. The thickness of this frost is controversial; it is certainly not more than one millimetre and probably closer to 0.01 mm thick. It is theorised that this frozen water condenses on airborne dust particles in the southern hemisphere which are then transported across the equator and finally brought to the surface by the further condensation of carbon dioxide on them. This unique type of snowfall would probably not be visible to anyone living there, as the rate of deposition is so miniscule.

Other weather patterns that seem to occur only at high latitudes include the passage of cold fronts, the regular eastward migration of a series of high and low pressure cells similar to those on Earth and occasionally a sub-polar cyclone that is visible from orbit as a beautiful spiral cloud.

As on earth, the polar regions on Mars are the most inhospitable of all. Since the Martian equator is tilted 24 degrees from the plane of the orbit (almost the same as for the Earth), the same phenomenon of the long polar night occurs. The south pole is in the dark for 178 Martian days out of the 669 day year and the north pole is dark for 148 days. During the long night the ground gets cold enough to freeze out the carbon dioxide, as already mentioned, and the temperature remains constant at −123°C throughout the winter. At its maximum, the great white south polar cap has a radius of nearly 50 degrees (3000 kms) and covers an area 2.5 times that of Europe; in the north with its shorter winter, the cap radius rarely exceeds 30 degrees.

At times, fierce winds blow in the polar regions. This is indicated by dark streaks in the residual caps where the surface is believed to have been scoured free of ice by the wind.

Dust bowl

Almost directly on the opposite side of the planet from Chryse is Hellas Planitia. The largest impact basin on Mars, Hellas is about 3000 kms in diameter and its bottom is more than 4 kms below the mean level. The floor of this basin is often obscured by clouds of dust when the rest of the planet is clear.

There may, in fact, be no reasonably hospitable places in the southern hemisphere because of the winds and the dust. The great dust storms that occur once or twice in nearly every Mars year originate in the south. The reason is that the planet is closest to the Sun in the southern summer. Since no landings have been made in the south (except for the Soviet spacecraft Mars 3 in 1971 and Mars 6 in 1974, neither of which survived to tell any tales), very little is known about the winds in this hemisphere. Theoretical estimates of the velocities required to raise the dust approach 300 kms per hour.

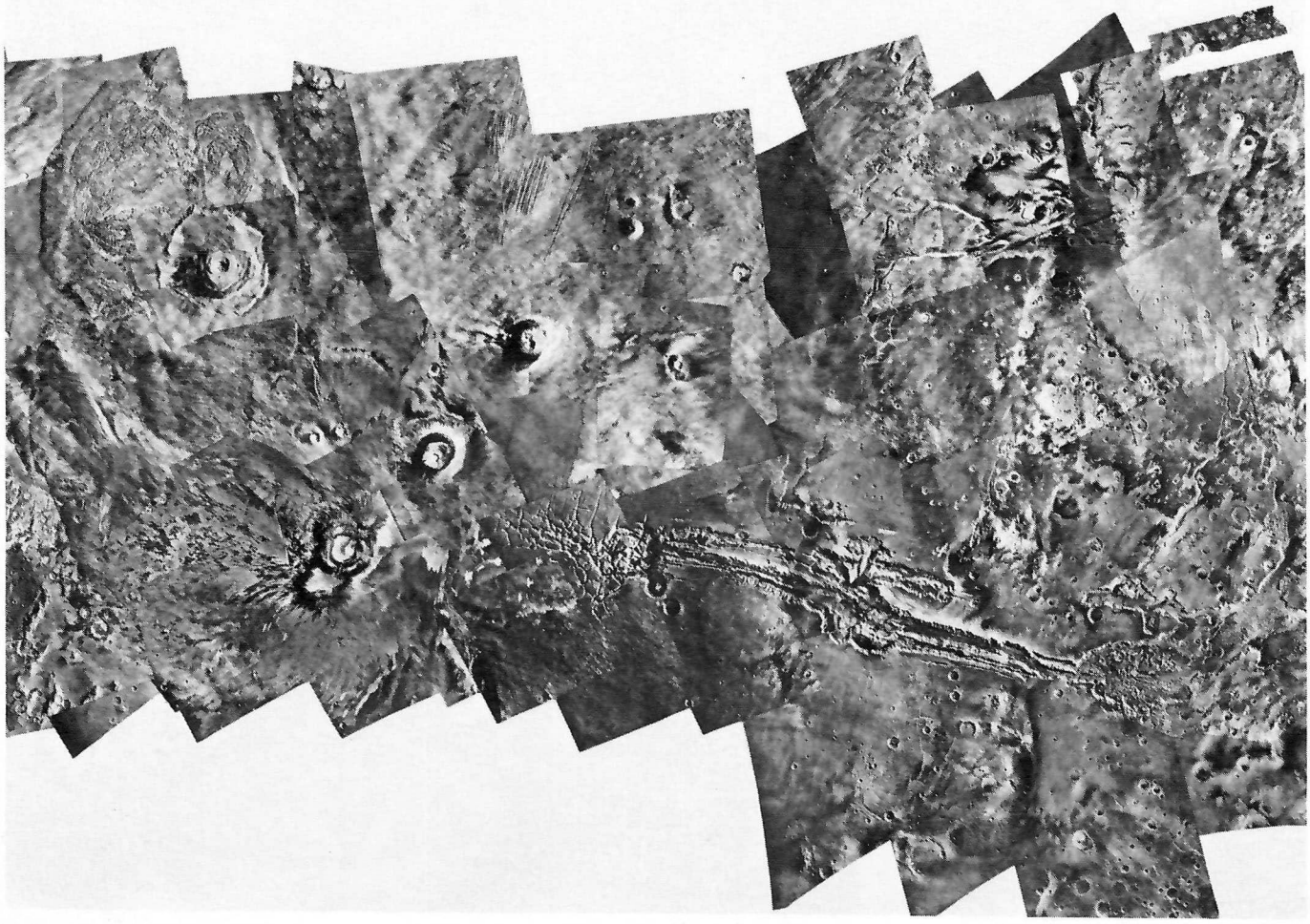
Does anything live there?

Most of the discussion about life on Mars has centred on the 'canals' that were described in 1877 by Giovanni Virginio Schiaparelli. Subsequent imaginative observers found more canals and explained them as the works of intelligent beings. It was not until the photographic coverage by Mariner 9 in 1971 that it became clear that most of the canals never existed and only a few linear features exist at the places where some canals were supposed to be.

A variety of subtle but unmistakable changes in the appearance of Mars have been observed over the years. Some of these are seasonal and repeatable, and it was postulated that they might indicate the growth and death of plants. The Mariner 9 pictures provided strong evidence that such changes result from a redistribution of dust by the wind.

The Viking landers carried out five distinct

This mosaic of Viking Orbiter photographs shows an area about 7500 km east-west by 3300 km north-south. Just left of centre are the three Tharsis volcanoes: Ascraeus Mons (top) at 11 N, Pavonis Mons on the equator, and Arsie Mons (bottom) at 9 S. Olympus Mons is at the upper left. Viking Lander 1 sits in the smooth region near the upper right. The complex of canyons that constitute the Valles Marineris extends from the centre to the right hand edge. Photo: NASA



investigations pertinent to the question of life on Mars. None of the 4000 pictures taken have yet shown any trace of animal or plant life. A sensitive chemical analysis device on each lander, a combination of gas chromatograph and mass spectrometer inspected samples of surface material for the presence of organic chemicals that might have been synthesised by living organisms. In each of the samples at both landing sites, the instruments detected, at levels of a few parts per billion, faint traces of cleaning solvents used in their fabrication (thus demonstrating that they functioned properly) but found no other organic molecules. Since the dust that was picked up by the surface sampler had probably been deposited there by the wind from widely separate locations on the planet, the negative result of this experiment provides a fairly strong argument against there ever having been any living organisms anywhere on the planet at any time – but it does not prove it. All that it indicates is the presence on Mars of some agent that destroys organic molecules; this agent is probably ultra-violet sunlight, which is not filtered out by the thin atmosphere.

The other three life-seeking experiments wee carried out by the little one-cubic-foot biology laboratory on each lander. Each experiment attempted to detect the metabolic activities of any micro-organisms that might be in the soil. The basic assumption was that if there were any macroscopic life on Mars, there would have to be micro-organisms in much greater numbers. The three experiments were given rather non-descriptive names: gas exchange (GEx), labelled release (LR), and pyrolytic release (PR).

GEx was a respiration experiment. It incubated several samples of soil for times as long as several months. A gas chromatograph periodically measured the composition of the gas in the incubation chambers and either pure water or an organic nutrient solution was added to the samples. The first operation of this experiment provided one of the biggest surprises of the entire mission. As soon as water vapour was admitted into the chamber, carbon dioxide, oxygen, nitrogen and argon evolved from the sample. Most significant was the oxygen, nearly 20 micrograms coming from the 1 gram sample. It is believed that some oxygen-rich compound in the soil was being decomposed by contact with the water vapour. There is no consensus as to what this compound might be; suggestions have included peroxides, superoxides, manganese dioxide, potassium dioxide and others. The gas exchange experiment uncovered no evidence whatever for any metabolic activity, but the discovery of the unexpected oxydising nature of the surface material made the interpretation of the other biological experiments more difficult and uncertain.

Organic breakdown

The labelled release experiment looked for the decomposition of complex organic compounds into simpler ones – the kind of chemical reaction that occurs in animals during digestion. A nutrient solution containing radioactive carbon atoms was added to the samples and the biological reactions were to be detected by the evolution of radioactive gases. Indeed gas did appear as soon as the nutrient was added, continuing for about a day. The suddenness of the release was not what was expected from biological processes, and it is generally believed that the oxydising compound discovered by the GEx was decomposing part of the nutrient solution and that there was no clear evidence of metabolism.

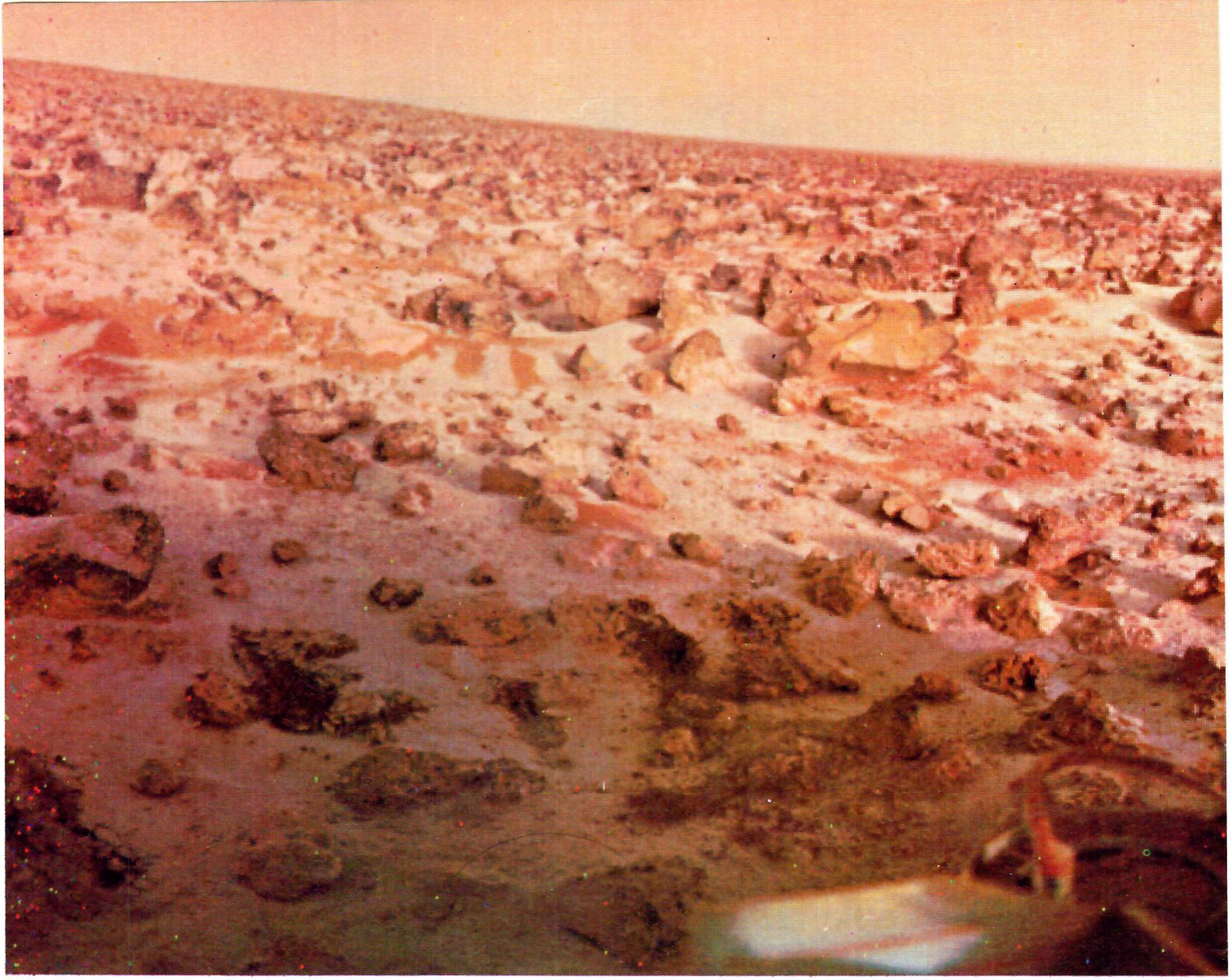
The pyrolytic release experiment also yielded what at first looked like a positive result. It was searching for the synthesis of organic compounds from atmospheric gases, the kind of processes that go on in plants. The soil samples were exposed to radioactively-tagged carbon dioxide and carbon monoxide. Any complex molecules that had been synthesised would then be decomposed by heating to a high temperature (pyrolysis), and the decomposition products would be detected by their radioactivity. Surprisingly, seven of the nine PR tests did detect something. The quantity of organic material apparently synthesized was very small, however, corresponding to between 100 and 1000 bacterial cells. The results are still not well understood, but it appears that whatever reaction was involved, it cannot have been a biological one because it was still observed when the sample had been heated above a temperature that is reasonable for living organisms.

The final conclusion is that there is no clear evidence for any life at the two Viking landing sites. Whether something or somebody lives somewhere else on Mars is still an open question, but it is harder to believe in this possibility than it was before Viking.

A variety of geologic features appear in this picture, which covers an area about 230 by 280 km in the southern hemisphere near Hellas. A flat-floored channel runs up the picture. Craters of all sizes occur, including the remains of one at the lower right that the channel has nearly obliterated. On the left are some large rock outcrops surrounded by debris flows. Photo: NASA

What's to see on Mars?

Probably the most scenic region on Mars is around the area called Tharsis. The peaks of each of three volcanoes shown in the Viking photographs reach up to 27 kms (nearly 89 000 feet) above the mean level of Mars. They sit atop an enormous bulge, more than 2.6 million square kilometres of which is above 9 kms elevation (29 500 ft). Thus an area four-fifths the size of India was raised up higher than the peak of Mount Everest by some internal upheaval. Relatively few impact



This was taken in mid-winter in May 1979. It is noon and the Sun, low in the sky, casts a large shadow of the spacecraft over the left side of the picture. Note that several trenches in the surface have been excavated within the shadowed area and that most of the surface is covered with a layer of white frost. Photo: NASA.

craters are found in the Tharsis region because the volcanoes have been pouring out lava up to relatively recent times, geologically speaking.

Just northwest of the bulge is Olympus Mons, the largest mountain in the solar system. Its peak is also at 27 kms, but its base is at 2 kms and it is about 550 kms in diameter. Its edge is delineated by a steep cliff, as much as 6 kms high in places, and lava from the volcano has flowed as much as several hundred kilometres beyond the cliff.

Lava flows

All the great mountains on Mars are 'shield volcanoes' produced by the repeated eruption of very fluid lava, which flows for long distances before solidifying. Consequently the mountains are not steep; only one of them has flanks that slope as much as 10 degrees, and 2 or 3 degrees is more common. Steep and rugged mountain ranges like the Alps or the Himalayas are absent on Mars because no major horizontal motions of the crust appear to have taken place. The winds blowing up the slopes of the mountains in the early morning commonly produce clouds that hide all but their summits.

The uplift of Tharsis was also responsible for another major Martian attraction, the great complex of canyons called the Valles Marineris. Taking its name from the Mariner spacecraft that discovered it, this feature stretches for about 4500 kms south of the equator and east of Tharsis. The central portion of the largest canyon is more than 700 kms long and 7 kms deep. They were produced, not by water, but by seismic activity and they may still be enlarging very slowly as the edges slump into gigantic landslides.

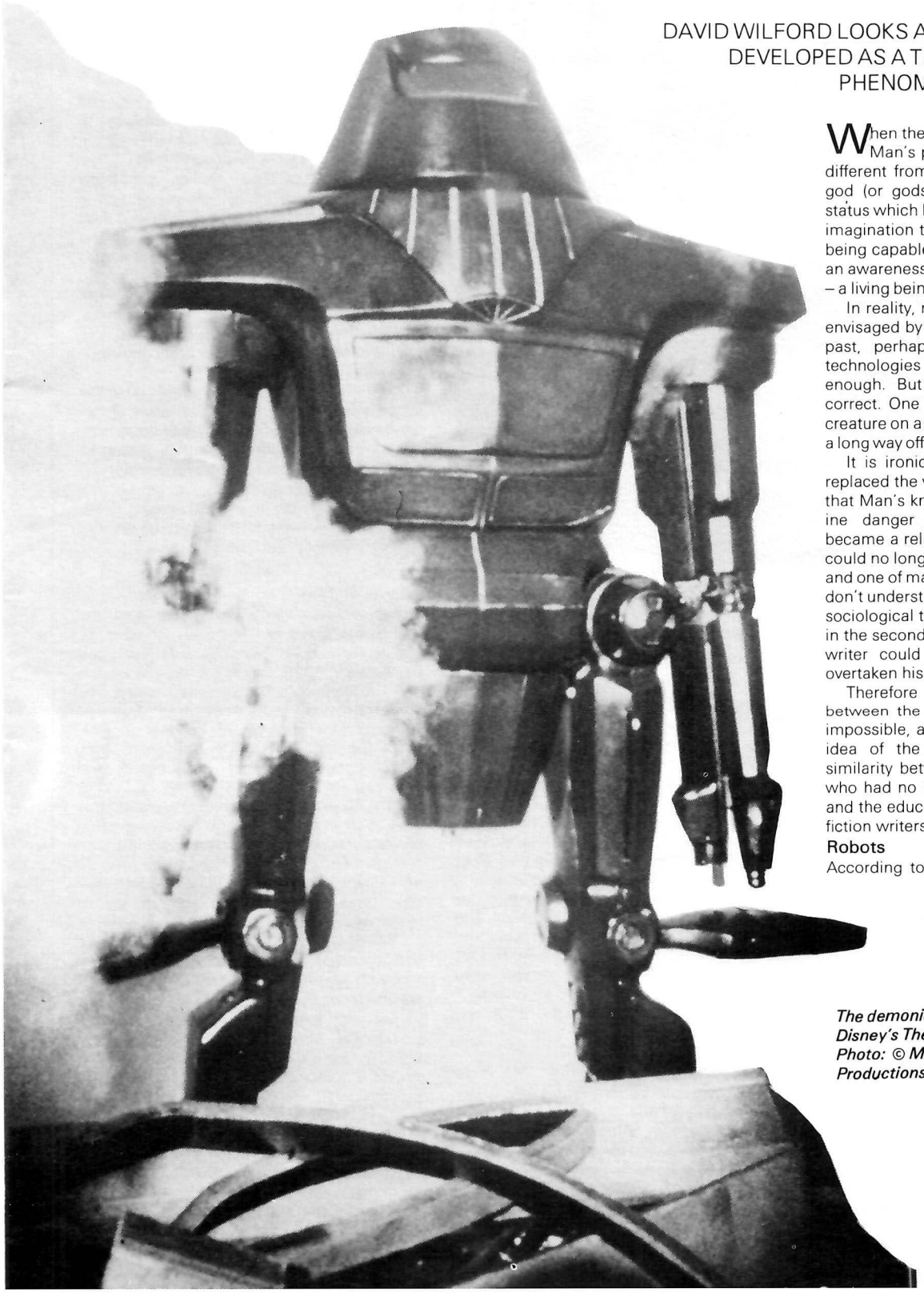
There are, however, features on Mars that appear to have been formed by the erosion of flowing water. These are the so-called *channels* discovered by Mariner 9, and they have caused almost as much controversy as the traditional canals. The smallest of these, which occurs in great numbers, can barely be seen in the best pictures, while the largest ones may be hundreds of kilometres in width. Some have multiple tributaries, and some show a twisted and braided configuration in their floors. Many channels have no apparent source and none has any obvious termination such as a delta. Some, on the other hand, clearly originated in large holes in the ground.

Future Vikings

The channels are prime sites for future exploration. Another interesting region is around the poles. When the north pole recedes in summer, it uncovers an enormous field of sand dunes that encircles the residual water ice cap. Also revealed is a region of layered terrain, with alternately bright and dark layers from 5 to 50 metres thick. The alternating colours were probably caused by periodic variations in the climate. This layered terrain, the channels and other evidence has led to the conclusion that Mars had a much denser atmosphere in the distant past than it has now, so that liquid water could have existed at the surface. Perhaps it would have been better if we had made our visit to Mars a few million years ago, instead of waiting until now!

ROBOTA

DAVID WILFORD LOOKS AT HOW THE ROBOT HAS DEVELOPED AS A THEME IN FICTION AND A PHENOMENON IN OUR SOCIETY



When the robot became a theme in fiction, Man's position in the universe was very different from now. All life was created by a god (or gods). To give himself the god-like status which he felt he deserved, Man used his imagination to pretend that he could create a being capable of conscious thought, and with an awareness of its place in the order of things – a living being.

In reality, robots are very different to those envisaged by the science fiction writers of the past, perhaps because our grasp of the technologies involved is not yet developed enough. But perhaps the SF writers were correct. One day we may be able to build a creature on a par with ourselves, but that day is a long way off.

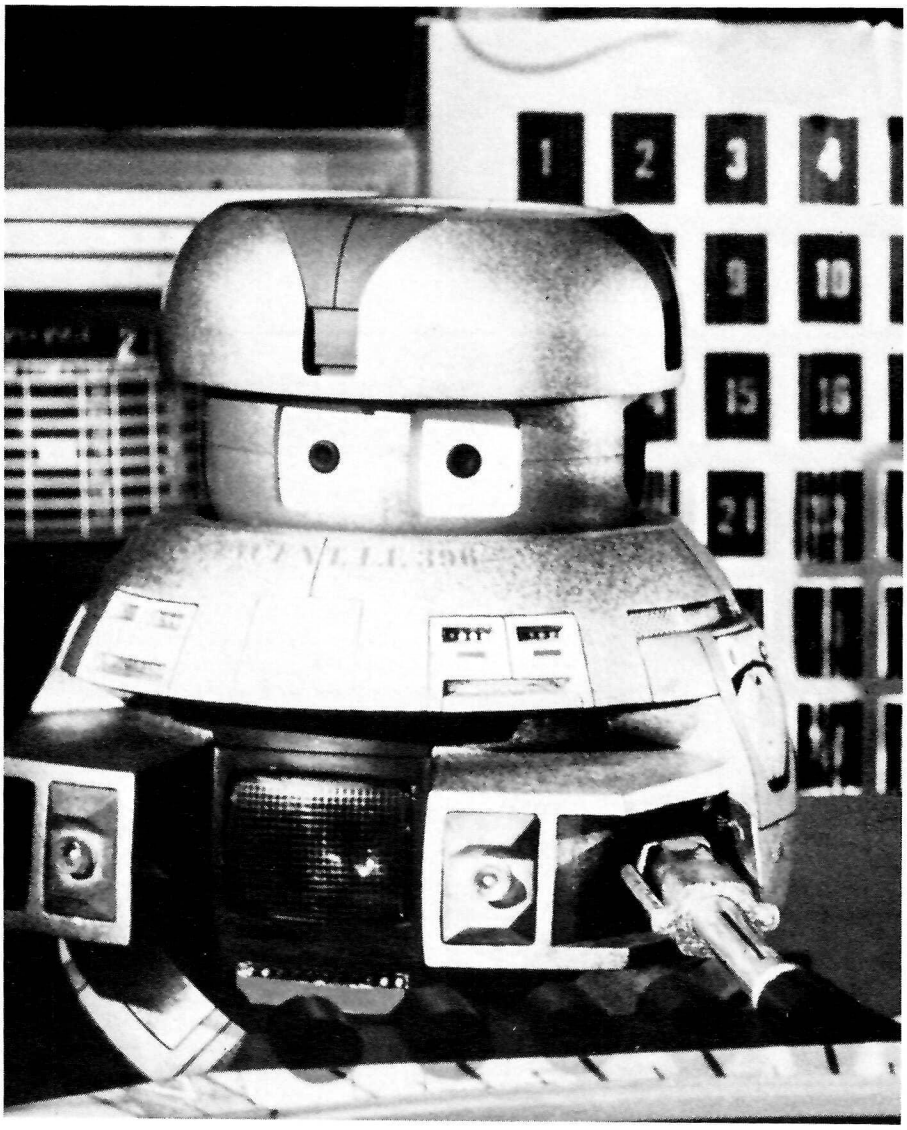
It is ironical that the worship of Science replaced the worship of God at about the time that Man's knowledge was becoming a genuine danger to the environment. Science became a religion when the man in the street could no longer keep abreast of developments and one of mankind's oldest instincts is – if you don't understand it, worship it! SF developed a sociological trend. With the speed of progress in the second half of the twentieth century, no writer could be certain that fact had not overtaken his fiction.

Therefore there was a change in attitude between the mythological conception of the impossible, and the post industrial revolution idea of the possible. There is a marked similarity between the ideas of those writers who had no idea of what might be achieved, and the educated guesses of the later science fiction writers.

Robots

According to Lucian Of Syracuse, a massive

The demonic Maximillian from Walt Disney's The Black Hole. Photo: © MCMLXXIX Walt Disney Productions.



This animated dust bin from The Black Hole proves that robots come in all shapes and sizes. **Photo: © Walt Disney.**

metal man ran amok around the island of Crete, destroying everything in its path. It was eventually stopped by the witch Medea who took a plug out of its heel allowing its life fluid to run out.

This was one of the world's first fictional robots. Other creatures which could be termed 'robotic' appear in Greek mythology – the warriors who leap from the Earth to fight Jason of the Argonauts, the metallic helper of the fire God Hephaistos (Vulcan). There was no idea that such metal or artificially animated men could ever exist.

Mary, Mary quite contrary . . .

In 1817 the first true SF novel, with a foundation in fact emerged. It was written by Mary Shelley, and was called *Frankenstein.* Not only did this work discuss in layman's terms the possibilities raised by a new technology, but also questioned its morality.

Frankenstein is probably the most successful, and certainly the best known, robot novel ever. It predicted robotics and medical transplants and was the watershed for every SF novel up to Isaac Asimov in the early 1940s.

Frankenstein was remarkable because it put the creation of an artificial being in a scientific rather than a magical or divine context. Mary Shelley made a genuine effort to describe the monster's construction in scientific and physical terms. The story of the creation that turned on its maker and brought about his death is one that was repeated again and again throughout the 19th and early 20th centuries. This trend reached its high point in E M Forster's *The Machine Stops* – the story of a world ruled by one great machine that has brought about the total subjugation and reliance of mankind. One free spirit rebels, and cries to his mother, who is a dedicated servant of the machine: 'You talk as if a god had made the machine . . . I believe that you pray to it when you're unhappy. Man made it, do not forget that. Great men, but men.'

Dream machines

The Machine Stops was written in 1912. It was typical of one of the two main genres of 'futuristic' fiction of its day. The other main trend was the very opposite. Writers like H G Wells and Jules Verne had foreseen a 'Golden Age' of leisure and luxury in a world where Man used machines for his benefit, rather than becoming dependent on them. Their style of fiction was fantastic and speculative in the atmosphere of a recently industrialised society. This was an age when time machines and invisible men seemed to be possible.

This golden age, in which mechanical men figured as considerate and caring servants lasted until the first World War, when man finally saw that the fruits of scientific research could be used, not just to help, but also to kill.

In 1923 a play, *RUR* was first produced. It was written by a Czech, Karel Capek, and was where the term 'robot' originated. It came from the Czech word *robotnik,* which means worker. *RUR* stood for *Rossum's Universal Robots,* and told the story of a man who built mechanical creatures which after first acting as his servants eventually turned on him and killed him – the *Frankenstein* syndrome reasserted.

All through the rest of the 1920s and 1930s this theme was almost universal in robot stories. Men created machines which killed them. With his invention of The Three Laws of Robotics Isaac Asimov completely changed the face of SF. He developed a pseudo-scientific theory that covered this then pseudo-science with the invention of the positronic brain. His first law, that *'A robot may not injure a human being, or through inaction allow a human being to come to harm'* dispelled the 'rogue robot' theme almost entirely. Other writers accepted the laws, and the robot became regarded almost purely as a machine.

Even so, most of Asimov's stories gave the 'rogue robot' theme a wry twist. While all his robots were safe, his humans could not accept that they were. No other writer has written so much or so well about robots. His position on the 'Frankenstein Complex' (as he himself called it) is summed up in the question: 'Does an automobile want to fly? Does an electric light bulb want to type letters?'

Robots on film

The first robot film, *The Clown and the Automaton* came out in 1897. Directed by Meliés, it has been lost since. Lumière filmed *La Poupée* in 1899. This was a musical version of E T A Hoffman's *The Sandman,* which, like *The Clown and the Automaton,* featured androids rather than robots. The first genuine robot appeared in 1906 in *The Motor Valet,* which, believe it or not, went beserk and smashed up its master's belongings. Other films such as *Mechanical Husband* and *How They Work in the Cinema* (which showed that film stars were really robots) were comic. The first robo-horror film was *The Master Mystery* of 1918, which starred Harry Houdini. This again was symptomatic of the change of feeling brought about by the first World War.

The robot became a central figure in SF and horror movies. Such classics as *Undersea Kingdom, Mysterious Dr Satan* and *Zombies of the Stratosphere* were regular features in the thirties and forties cinema. None of them presumably were to be taken particularly seriously, but it must be born in mind that the original *Dracula* was slated as being 'immoral and sick'.

Made in 1926. Fritz Lang's *Metropolis* is a vision of a city of the future. Rotwang, played by Rudolph Klein-Rogge, says 'We have made machines out of men – now we will make men out of machines.' Brigitte Helm plays a female robot remarkably sophisticated for its/her time.

This contrasts with robots featured in later films such as *The Monster and the Ape* (1935) or *The Phantom Creeps* (1939). In the serious cinema robots were part of a future civilisation, while in the pulp films, they were merely tools of escapist fantasy.

Classic robots

When most people think of robots in the movies, two or three spring immediately to mind. The first of these, and still the greatest of cinematic robots, is Robbie, who featured first in *Forbidden Planet,* then *The Invisible Boy,* and finally in the TV series, *The Space Family Robinson.* Then of course there is the modern classic C3PO from *Star Wars, The Empire Strikes Back* and *The Return of The Jedi.* And finally Ash, as played by Ian Holm in *Alien.* Ash is not a true robot. He is indistinguishable from a human being (therefore an android).

Robbie, despite a recent challenge to his position by C3PO, is still *the* cinema robot. He was created by MGM, and was remarkable primarily for the affection which he could generate. He combined enormous physical power with superhuman benevolence. The scene in *Forbidden Planet* in which he is instructed by Morbius to shoot Commander Adams, and proves incapable of doing so – almost blowing a fuse in his dilemma – shows up his essential goodness (if a machine is truly capable of goodness). In *The Invisible Boy,* he is deprived of his 'conscience mechanism' and kidnaps his former playfellow, his inventor's ten-year-old son. However, he regains his conscience, and the boy is saved.

C3PO also has many human characteristics. However his are not so praise-worthy as Robbie's. It would be fair to say that cowardice and hypocrisy are his two main features. R2D2, his Droid side-kick, more than makes up for what C3PO lacks in moral fibre. The other side of C3PO's character is composed of loyalty and an ability to indulge in friendship.

Ash, from *Alien,* is physically the closest of this triumvirate to humanity. At the same time though he is the least 'humane' of the three. He is capable of deceit, treachery and murder. His character is far more complex than those of Robbie or C3PO. Being on board *The Nostromo* for reasons other than those presumed by his shipmates, he has got to deceive. Essentially, he believes that he is acting for the good of mankind, since he has been programmed to bring the alien back to Earth to be used as a machine of war.

These three robots sum up between them the three most popular conceptions of robots in fiction. All three show human characteristics, covering the spectrum from sanctity to evil. Most fictional robots have really been nothing more than mechanical people created by scientists. Occasionally there has been a novel or film in which the writer has explored such themes as race or social class using robots as an illustration. Practically designed robots, which break the quasi-human mold, have appeared in the occasional film – most notably *Gog* (1954) and *Silent Running.* But on the whole, the robot theme has stuck to fairly well-worn tracks, most of them well away from reality.

Terms and Definitions

The current definition of robotics is, according to Edward Safford the author of the comprehensive *Handbook of Advanced Robotics:* 'The design, use and operation of machines which are computer controlled to do human desired tasks.'

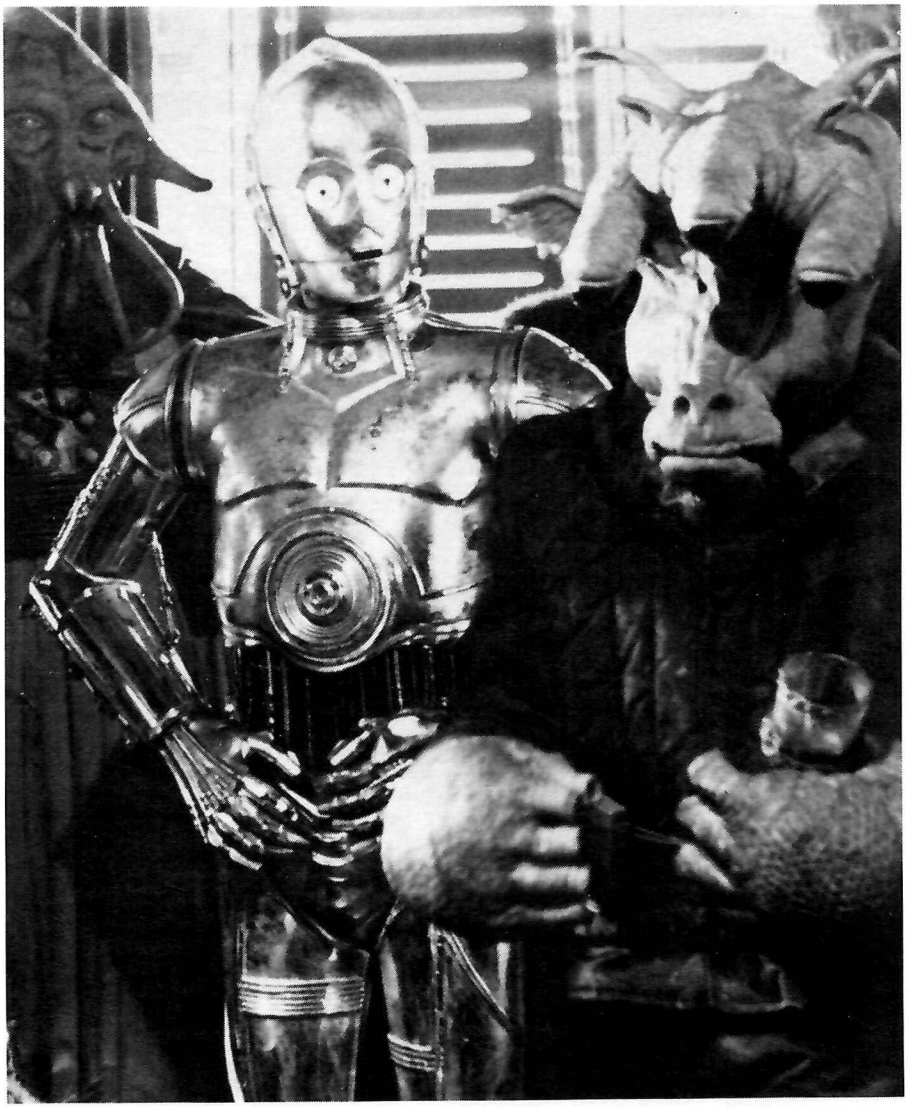
Robot: 'A general term which stands for an automated unit which does have some kind of human symbolisation in its operation or physical structure. It may not look human, but it seems to be able to perform human type functions and actions.' This terminology covers those machines which operate in factories or in Space. They are no more than machines programmed to carry out a number of functions.

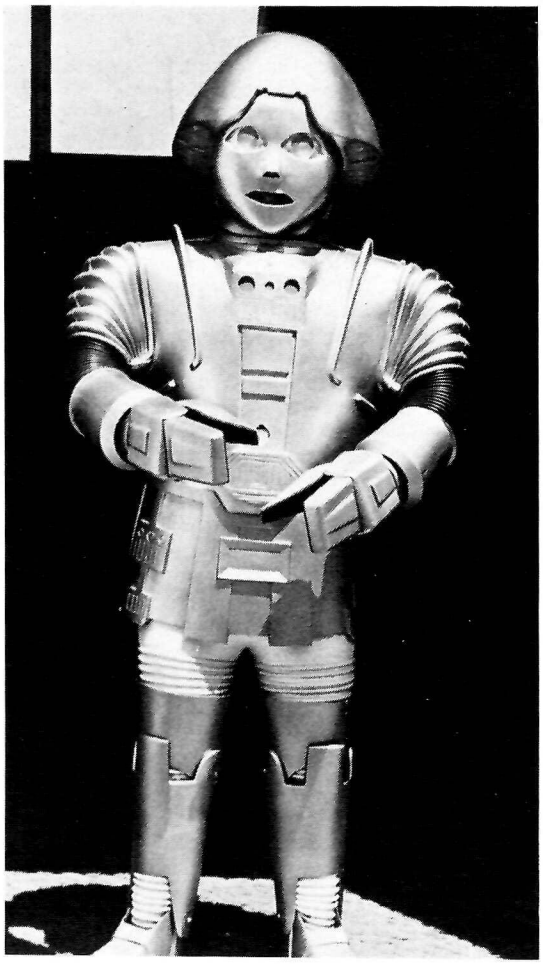
Android: 'A human appearing type of machine which duplicates in appearance and some actions the human body and its functions. It may converse, and does respond to external stimulii with pre-programmed responses.' The android is closest to the robots of SF. Quasar Industries of Rutherford, New Jersey claim that a domesticated android can be programmed to fulfil the following tasks:

1. Answer the door when guests arrive. Take and hang up their coats.
2. Serve previously mixed drinks from a tray.
3. Vacuum, polish floors and do the dusting all guided by a program.
4. Monitor the house for excess smoke.
5. Monitor the house for excess heat or cold, and adjust the temperature as necessary.
6. Keep an eye on children and invalids, giving a warning if behavioural patterns differ from the norm.
7. Respond to verbal communication and provide information.
8. Be used as an educational aid, or for amusement.
9. Be used to cut the grass, walk the dog and for other simple outdoor tasks.

All these tasks can obviously be carried out by a human, and so for the time being at least the domesticated android is little more than a status symbol.

A modern classic – C3PO with friends of rather dubious repute. **Photo: © 1979 20th Century-Fox Film.**





Karloff's Frankenstein creation (left) – the most famous movie monster of all time. Photo: Universal. The cute little android from Buck Rogers in the 25th Century (right). Photo: C.I.C.

Robots today

Today robots are machines designed for specific jobs, which are either too dangerous or too boring for Man. Each Robot is designed for a specific task. A machine designed for collecting rocks from the surface of Mars would be entirely incapable of building a car.

It is only too easy to anthropomorphise. Intelligence of the sort apparently met in computers and robots is of an order only otherwise met in mankind. When a machine reacts to verbal commands, it is not easy to grasp that all the machine has done is respond in a pre-programmed manner. It is easy to imagine that it has reacted in a human way. Man, however, is the natural result of apparently random forces, which have come together to make him what he is. He is not a manufactured being in the same way as is the robot. However powerful the computerised brain of the robot, it is totally useless without instructions from its programmer.

Doubtless, one day robots will be capable of replacing humans in almost every capacity in the working world. From today's standpoint, this is a bleak vision indeed, but we need not look forward with dread to a day when manufacturing industry has been dehumanised, and the former workers are living in poverty, sloth and squalor. A society in which the work is not done by humans who have to be paid, but by a corps of tireless, efficient and selfless beings, will promote a high standard of living for all, and sufficient spare time in which to enjoy it.

Dr Morbius (Walter Pigeon, right) commands Robby the Robot to kill the captain of the rescue ship. Will the laws of robotics allow him to do it? All was revealed in 'Forbidden Planet', made in 1956. Photo: © MGM

ASTRONOMY ON A SHOESTRING

DO YOU NEED AN EXPENSIVE TELESCOPE TO TAKE UP ASTRONOMY? IS IT WORTH BUYING A CHEAP TELESCOPE? WHAT CAN YOU ACHIEVE WITH SPORTS BINOCULARS? PATRICK MOORE HAS ALL THE ANSWERS

What is the popular idea of an astronomer? Probably an elderly man with a long white beard, sitting at the eye-end of a telescope in a lonely observatory watching the stars. This picture was never true, and it is certainly very wrong today. Your astronomer is much more likely to be young, energetic and spending most of his time in a comfortable control room, watching the telescopic information as it comes through on a TV screen!

If you aim to be a professional scientist, of course, you have to have all the resources. But there are amateur astronomers too, and they play a really useful part in research. In fact, it is probably true to say that atronomy is just about the only science in which amateur co-operation is eagerly sought by professional workers. There is a great deal of useful observational work to be done.

Telescopes are expensive. In my own view (others may not agree), I would not pay much for a very small telescope. As I am sure everyone knows, telescopes are of two types – refractors, which collect their light by means of a lens or object glass, and reflectors, in which the light collector is a curved mirror. I have always found that the minimum useful size for a telescope is a three inch refractor (that is to say, a refractor with a lens three inches in diameter) or a six inch reflector (a reflector with a mirror six inches across).

Finance now raises its ugly head. When I started to take a real interest in astronomy, I was able to buy an excellent three inch refractor for £7.10s. I still have it, and I still use it. But that was when I was aged eleven – in 1934. Today, the same telescope would cost in the region of £200, and the same goes for a six-inch reflector. Moreover, second-hand telescopes of good quality have now become about as rare as great auks. A word of warning here. Never buy a second-hand telescope unless either you are expert enough to judge its quality, or you call in somebody who is. A bad telescope, especially a bad reflector, may not betray its faults at a glance.

Optical options

If you do not want to spent £200 (and I mean this as a minimum) you have a clear-cut choice. You can buy a very small telescope, such as a two inch refractor, for a few tens of pounds. You can go for a four inch reflector, which will be considerably more. Or you can choose binoculars.

So far as I am concerned, there is no argument. I would select the binoculars every time. There are several reasons. First, a small telescope such as a two inch refractor will have a very small field, and will not bear a magnification high enough to give you, say, a reasonable view of Saturn's rings. Some advertisements are frankly stupid; I saw one recently in which it was claimed that a $2\frac{1}{2}$-inch refractor would bear a power of 400! Secondly, such a telescope will be awkward to use. Please do not misunderstand me. I am not saying that a very small telescope is useless. Of course it is not; it is far better than nothing at all – but I would not pay much for one myself.

Pros and cons

Come now to binoculars. Here we have one initial and very real disadvantage – the lack of high magnification. Generally, for reasons I will give you in a moment, the power used will be

Perfectly adequate for amateur astronomical observations – 10×40 binoculars (the pair on the left are rubber armoured). Photo: Leitz.

not more than 12, and probably less. This means that the rings of Saturn are well out of range. But otherwise, binoculars have much in their favour. They are easy to handle; they are of course portable (though remember never to use them unless you have the safety-cord slung round your neck; otherwise it is only a matter of time before they get dropped). They give a wide field. And they are useful in the daytime as well, which a small astronomical telescope is not. Bird-watchers naturally use binoculars, and I gather with great success, though I admit that my bird recognition is very poor. The only birds I can recognise with certainty are the sparrow and the hen! Neither do they require any real maintenance, and unless some accident happens they will last you a life-time without the need for any adjustments at all.

Binoculars come in various sizes and powers. They are characterised by their magnifying power and the diameter of each object glass in millimetres. Thus 7×50 means that the magnification is seven and each object glass is 50 millimetres across. In theory there is no limit to either the magnification or the aperture, but in practice there is. The higher the power, the smaller the field of view, and in addition the weight of the binoculars increases quite rapidly. I have a 7×50 pair, which is ideal for most purposes. I also have 8×50, which give a smaller field but show more detail, and a 12×60, which I like and which I used, but which is not easy to hold steady. Above a magnification of 12, some sort of mounting is more or less essential. It need not be at all elaborate, and it can be knocked up easily by anyone who is at least reasonably 'handy'. All that you need are some bits of wood (broomsticks?) and ingenuity.

Therefore, you have to come to a decision. If you want the binoculars for daytime use as well as for astronomy, then I would choose a magnification of between seven and ten, and an aperture of anything up to 70 millimetres, though 50 millimetres leads to a lighter pair and less strain on one's arms. If you want them purely for astronomy, and are prepared to make some sort of an elementary mounting, then go up to power 12 by all means.

Safe Sun sighting

The only logical way to observe the Sun with optical aid is by the projection method – fixing or holding a white screen or card behind the eyepiece(s). This works well with a telescope, but its not really for binoculars. I do not recommend it. And even when the Sun is low over the horizon, shining redly through the mist and looking deceptively harmless, it is just as dangerous as it is at any other time. In fact, there is only one rule for direct observation of the Sun through any telescope or binoculars; DON'T. (Neither is it advisable to stare straight at the Sun with the naked eye.)

Having disposed of the Sun, let us turn to the Moon, where the situation is quite different. To all intents and purposes the Moon sends no heat, and although you may dazzle yourself you cannot possibly do your eyes any harm. So observe the Moon by all means.

Binoculars, in fact, will show you a great deal. Even the naked eye can pick out the grey plains which we still call seas even though there has never been any water in them. You can see, for example, the huge Mare Imbrium (Sea of Showers) and the complex make up of the Mare Tranquillitatis (Sea of Tranquillity, where the first Apollo astronauts landed) and the Mare Foecunditatis (Sea of Fertility), as well as the small, isolated Mare Crisium (Sea of Crises) to the upper right-hand side of the lunar disk. Binoculars will show you these very clear, and also many of the lunar craters, which dominate the surface. Some of the craters are huge, exceeding 150 miles in diameter. When they are near the terminator – the boundary between the daylit and night hemispheres of the Moon, over which the Sun is just rising or setting – the craters are at their best, with long shadows stretching inside their walls, and very often with central peaks. Use an outline lunar map, and you will soon start to find your way around.

Perhaps rather surprisingly, full moon is not a good time to start crater-hunting, because there are no shadows, and the whole scene is dominated by the systems of bright rays or streaks centred upon two craters, Tycho in the southern (lower) part of the Moon and Copernicus nearer the equator.

Note, also, that when the Moon is a crescent, your binoculars (or even the naked eye) will generally show the night region shining faintly. There is no mystery about this; it is earth-shine – light reflected on to the Moon from the Earth. When the Moon passes into the Earth's shadow, at a lunar eclipse, binoculars really come into their own, and the spectacle is glorious.

Scanning for planets

So far as the planets are concerned, I'm afraid that there is not a great deal of scope. You will certainly be able to see the phase of Venus when that rather unwelcoming world is a crescent. Jupiter will appear as a blob, and you should be able to make out at least one or two of its four bright moons or satellites, three of which are larger than our Moon and the fourth only slightly smaller. Saturn – well, you may be able to tell that there is something unusual about its shape, but the rings are beyond binocular resolution. If you have a star map and an almanac you will be able to find the two outer giant planets, Uranus and Neptune, as well as quite a number of the asteroids or minor planets which move mainly between the orbits of Mars and Jupiter, but all these will look exactly like stars.

Among the stars themselves, the scope is endless. First try for some star-fields, by looking along the band of the Milky Way. The stars seem to be countless, and to give the impression of being so crowded that they are in imminent danger of bumping into each other. As so often happens, appearances are misleading. When we look along the main plane of our Galaxy, which is a flattened system, we see many stars in almost the same line of sight – which explains the Milky Way. But your binoculars will show one superb star-field after another.

There are clusters of stars, too, away from the Milky Way. Quite a number are easy to see with binoculars. The Seven Sisters, or Pleiades, show more than the seven stars visible with the naked eye. Look for Messier 35 in the constellation of the Twins; Praesepe, or the Beehive, in the Crab; the dim blur of the globular cluster in Hercules, and so on. Gaseous nebulae, where stars are being born, are also on view; the best is the Great Nebula in Orion's Sword. And do you want to see a sytem so far away that its light has taken over 2 000 000 years to reach us, so that we are seeing it as it used to be before the Ice Age? Binoculars are adequate; you can find the Great Spiral in Andromeda, which is a galaxy bigger than our own, and contains more than our galaxy's quota of 100 000 million suns.

Shopping around

Next, cost and availability. I must be rather wary here, because prices seem to spiral every day, but I would say that a good pair of 7×50 binoculars will cost considerably less than £30 if you shop around. I confess that railway lost property offices often have what may be regarded as bargains – it is quite amazing how many people leave their binoculars around and never claim them. Again, make a careful check before buying, but this is reasonably easy, because you can simply try the binoculars out there and then. If they give a good image, with sharp focusing, you should be safe. Beware of the old-fashioned opera glasses, which crop up now and then. I have never found a pair which gives a satisfactory image, though I may have been unlucky.

If you prefer to buy a new pair, then most good optical shops will provide them. May I repeat – never hold the binoculars to your eye until you have looped the safety-cord round your neck! It is tempting to ignore this when taking just one quick glance, but it is bound to lead to disaster sooner or later – probably sooner.

So we now have our binoculars, with a power of between seven and 12 (probably between seven and ten) and an aperture of 50 millimetres or so, though in fact 30 millimetres is quite adequate; all that happens is that you do not have quite so much light to spare. What shall we observe?

There is one thing which you must *not* observe, and that is the Sun. I have lost count of the number of times I have given this warning – in books, talks, and TV and radio programmes. The surface of the Sun is at a temperature of nearly 6000 degrees Centrigrade. Focus the sunlight, and sun heat, on to your eye and you will blind yourself permanently. Even a second's exposure will be tragic. This is not simply idle talk; I have known several cases of blindness being caused in this way – and if anything, the danger is even greater with binoculars than with a telescope, because both eyes can be affected instead of only one. Neither is a dark filter of real use. I have seen advertisements for dark caps which, it is claimed, can be fitted over the binocular (or telescope) eyepieces and which make direct observation of the Sun safe. This is quite wrong. No filter can give proper protection, and in any case a filter is always liable to crack or splinter without warning. If you ever come into possession of a sun-filter, my advice is to hire a rowing boat, row out several hundred yards, hold the filter at arm's length over the side of the boat, and then drop it!

You can even make out the much fainter galaxy in the adjacent constellation of the Triangle.

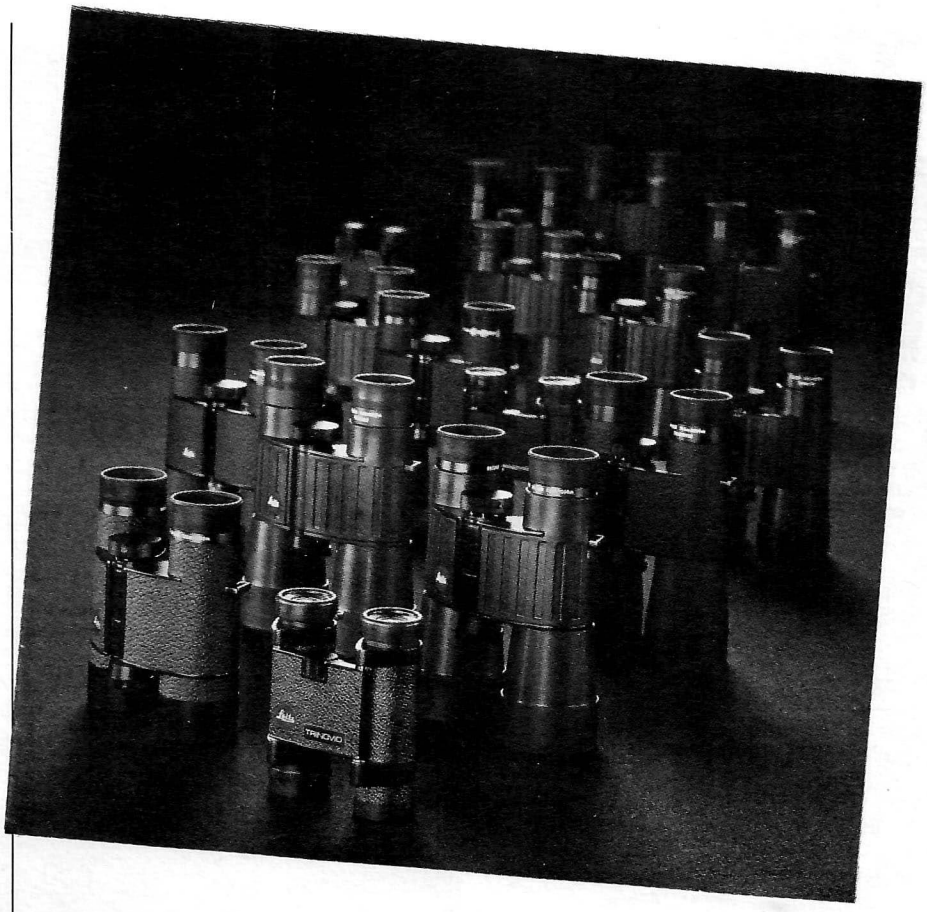
Moreover, the stars themselves are not alike. They are of different colours, because they have different surface temperatures; thus a bluish star such as Vega in the Lyre (almost overhead during Summer evenings) is hotter than our yellow Sun or the brilliant Capella in the Charioteer, which is almost at the zenith (overhead point) during winter evenings. These, in turn are hotter than the orange or orange-red stars such as Betelgeux in Orion or Antares in the Scorpion. The naked eye is not adequate to show many of these star-colours, because the light-level is too low except for the really brilliant stars, but binoculars open up the field at once. For example, look at first the Pole Star, and then the other brightish star in the Little Bear – Kocab, the Guardian of the Pole. The Pole Star is white: Kocab is orange. If you look around from one star to another, you will see the different hues which you will never notice without binoculars.

Sooty stars

There are some stars which are double – and some which are variable. Variable stars, which fluctuate in brilliancy over relatively short periods, can be well studied with binoculars, and useful scientific work can be done. The method is to compare the variable with nearby comparison stars, whose brilliancies are known and which are not themselves variable. With a little practice, estimates can be made very accurately. Let me give you one example. In the little constellation of Corona Borealis, the Northern Crown (not far from the brilliant orange star Arcturus) there is a star known as R Coronae. Generally, it is just below naked-eye visibility, but easy with binoculars. But sometimes, quite unpredictably, it fades – because apparently its atmosphere becomes overloaded with soot, and the star's light is blocked. When R Coronae drops to minimum, a large telescope is needed to show it at all; it taxes the power of the 15-inch reflector in my observatory in Selsey. Therefore, look inside the bowl of the Crown. There should be two stars visible: R Coronae, and a comparison. If you can see only one, you will know that R Coronae is putting on one of its performances.

And this brings me on to another topic: the amateur astronomers who make systematic searches for new stars or novae, and for comets. A nova is not genuinely a new star; what happens is that a formerly faint star flares up to many times its normal brilliance, remaining bright for a few days, weeks or occasionally months before fading back to obscurity. George Alcock, a retired schoolmaster who lives in Peterborough, is our most famous nova-hunter. He uses very powerful binoculars which are specially mounted, and he scans the night skies looking for any newcomers. Do not imagine that this is easy. He has memorised the positions and brilliancies of over 30 000 stars, so that he can recognise a new one at once. I well remember him telephoning me in the early hours of one morning way back in the 1960s, to say that he thought he had found a nova in the little constellation of the Fox. I was able to confirm it at once – though I would never have recognised it as being new had I not been told the position.

Equipment of this kind is, of course, very expensive, and to hunt for novae requires rare dedication, but if you are prepared to undertake such work you will have an interesting time – though it requires many hundreds of hours of patient, laborious searching before there is much chance of catching a nova!



Binoculars are readily available in a wide range of sizes, weights and powers, most of which are suitable for amateur astronomy. Photo: Leitz

Comet chasing

Finally, there are comets, those erratic members of the Solar System. A comet is not a solid, rocky body; it is made up of small particles (mainly ices) and very thin gas. Comets move round the Sun, generally in very elliptical paths; we can see them only when they are in the inner part of the Solar System – but if you see an object crawling noticeably across the sky, it canot be a comet. It will be either an aircraft or an artificial satellite. (I should add that in the early years of the Space Age, binocular-equipped amateurs did sterling work in tracking artificial satellites, and this is still done, though I am bound to admit that it is not as valuable as it once was.)

George Alcock has found several comets. So have other amateurs – again it means very special, expensive binoculars and complete dedication, though I must admit that there have been several accidental discoveries. Comets will be much in the news during the next year or two. Halley's Comet, the only bright comet which we can predict, is on its way back. It should come within binocular range around November 1985 and stay in sight until the spring of 1986, after which we will have to wait for its next return in the year 2061. If you want good views of Halley, then invest in a pair of binoculars. Good luck – and good seeing!

THE RIGHT STUFF

PHILIP KAUFMAN, DIRECTOR OF 'INVASION OF THE BODY SNATCHERS', HAS TURNED *THE RIGHT STUFF* INTO A MOVIE. IAN GRAHAM GIVES A PERSONAL VIEW

In 1981, like many other space buffs, I picked up a copy of a new paperback called *The Right Stuff* by Tom Wolfe (first published in 1979). It told the story of America's first astronauts, but not in the then fashionable manner of a knee-bending homage to the all-American hero – the macho superman fearlessly riding high atop his high-tech stallion rocket. It wasn't full of the tedious gee-whizz data about the hardware that journalists and authors latched onto at the time -- how many London buses you'd have to stack on top of one another to equal the height of a Redstone rocket, how many rivets held the Mercury capsule together, how quickly the QE2 could cross the Atlantic if it was powered by an Atlas rocket, and so on ad nauseam. No, *The Right Stuff* was the private story of the men and their families who bore the brunt of the first years of manned space test flying – and it's a cracking good read even if you're not a space nut.

The right stuff of the title is the name Wolfe gave to the intangible quality that the fliers who made it to the top of the, at times comically inept, selection procedure possessed. The only important thing was to make it through to the next selection board, the next series of tests, and the next, and the next . . . . The seven who make it to the end of the road were unveiled to the American public as their country's finest young men and they were indeed hailed as supermen before any of them had stepped into a Mercury capsule.

Meanwhile, on the other side of the continent, at Edwards Air Force base, pilots were almost routinely flying their X-series advanced rocket-powered aircraft to the edge of space and back again. The X-1 had started the stampede of bright young hopeful jet-jockeys to the Mojave desert, when it became the first aircraft to break the sound barrier in level flight. Captain Charles E ('Chuck') Yeager was at the controls. The X-craft pilots watched the televised and much written about exploits of their astronaut colleagues from beneath the shroud of secrecy that blanketed their work.

All for one . . . .

There was a good deal of animosity between the X-men and the Mercury astronauts. While the X-plane pilots flew their rocket planes as test pilots had always flown, by the seat of their pants, the Mercury astronauts merely sat on top of a gigantic firework that lobbed them into the wild blue yonder automatically. The astronauts eventually realised that the public interest in them, encouraged by the Government, gave them the power to control their own destinies within the Mercury program. Individually they were powerless, but if they acted en masse they could have what they wanted and retain their dignity as pilots.

To distinguish themselves from the chimpanzees which had been launched in the unmanned Mercury test vehicles, the astronauts insisted on having a window in the capsule, through which they could make observations, and on manually firing the retro-rocket that slowed the craft and started re-entry. They also insisted on a quick-release hatch that they could operate themselves after splashdown. Even so, the astronaut was sometimes referred to as the system's redundant component. Mercury was essentially an automatic system into which a human being was bolted as a passive payload – irreverently nicknamed spam in the can!

The film of the book

Soon after the book was published, film producers Irwin Winkler and Robert Chartoff selected it as their next project. After initial teething troubles, when the author of the original screenplay, William Goldman, left the project amid disagreements with the director, Philip Kaufman, production got under way. In the end, Kaufman both directed and wrote the screenplay.

Inside the Mercury capsule on February 20th, 1962, Ed Harris as John Glenn prepares to become the first American to orbit the Earth. Photo: © 1983 The Ladd Company.

The film follows the contrasting stories of the X-men at Edwards and the Mercury seven. Men like Chuck Yeager and Scott Crossfield routinely laid their lives on the line and received none of the public acclaim, ticker-tape motorcades or lucrative magazine contracts of the Mercury astronauts, who acquired a status normally associated with American footballers. Companies fell over each other in the rush to bestow everything from potato peelers to automobiles on the Seven.

It sounds like an idyllic life – a national hero with a fat bank balance and the world beating a path to your door. But the world's Press didn't stop at the front gate – they claimed the astronauts and their families as public property. They climbed over the garden fence, trampled through the garden and climbed all over the house to get their interviews and photographs.

Behind the scenes, the Government expected no less than perfection from its manufactured heroes. Anyone who didn't toe the line or make the grade paid the price. When the explosive bolts on Gus Grissom's capsule hatch blew prematurely, resulting in the loss of the capsule, he was denied the ticker-tape welcome home that his colleagues received, and his wife, played by Veronica Cartwright, didn't have the meeting with Jackie Kennedy at the White House that she'd set her heart on.

Miss Cartwright, who cried her way through *Alien,* cries her way through a good deal of *The Right Stuff.* She isn't the only grieving wife by any means. The shadow of the undertaker stalks the tight-knit community in the Mojave Desert. The flying community keep him busy and the wives dread the sight of him solemnly striding up the front path – he only ever calls for one reason.

The rate at which the bright young things fell out of the sky was reflected by the wall of honour at the fliers' local watering hole, the Fly Inn run by Pancho Barnes (a flier of note herself). Many a raw recruit suffering from an excess of the local brew loudly staked his claim for a place on the wall of honour, only to be told that the only way he could get his photo on the wall was to go out and get himself killed.

Throughout the scenes filmed in Pancho's, a tanned, walnut-faced old-timer shuffles around, sizing up the new-comers and generally making himself useful in an unobtrusive sort of a way. Occasionally his gaze meets that of Sam Shepard, playing Chuck Yeager. The meeting is a moment of time-slip – the man playing old amiable Fred is none other than General Charles E Yeager himself.

Playing for laughs

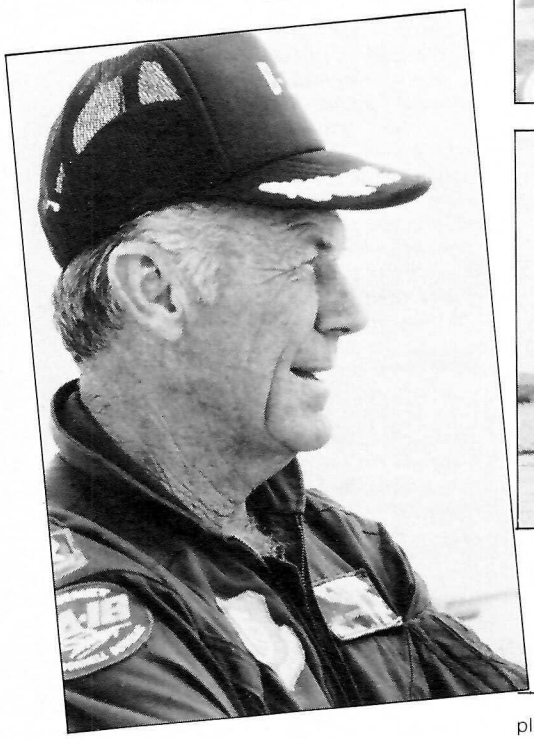
The Government officials are portrayed as

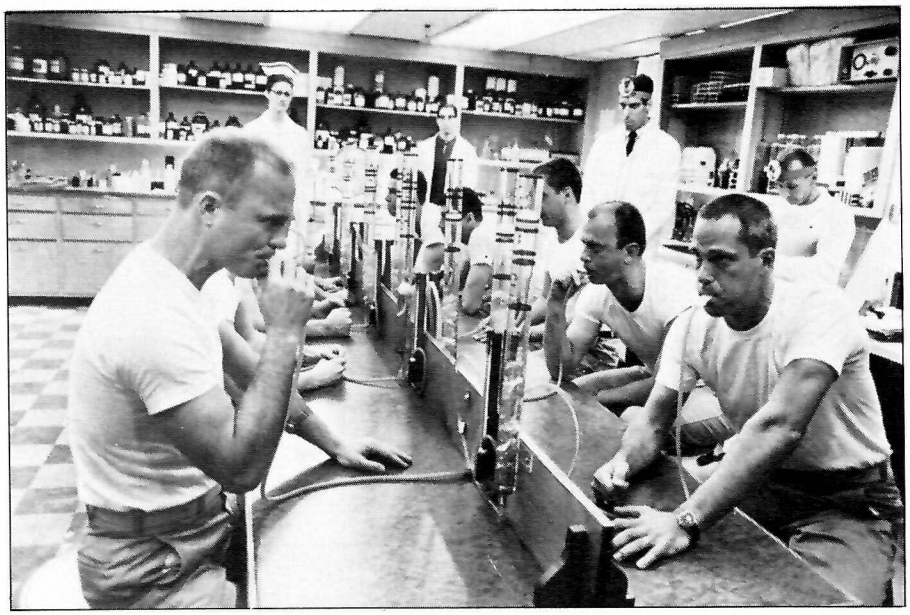
Below: Return to Earth. A Mercury Astronaut receives the adulation of the splashdown crew. Left: The Mercury astronauts pose in front of the capsule in which they will fly into space. Photos: © 1983 The Ladd Company

caricatures playing for laughs, in stark contrast to the more realistic way in which the astronauts themselves are played. Incidentally, the actors who played the Mercury astronauts were chosen because of their physical resemblance to the astronauts. In particular, Scott Glenn who plays Alan Shepard, and Ed Harris, who plays John Glenn, bear an uncanny likeness to their characters. The film's funny moments aren't restricted to inept G-men. The would-be astronauts often see the comic side of the ridiculous situations they are subjected to in the interest of research. The Seven come over as a likeable bunch of work hard/play hard pilots although Glenn, who subscribes to a higher morality than the others, chooses to stand apart from them. In return, they dub him Mr Clean the Marine.

Two films in one

The film seems to have selected several highlights from the race for space and concentrated on them. Once the selection and training phase is completed, the storyline focuses on the launches, the flights and their dramas, largely ignoring the intervening time. Meanwhile, in the other film within a film, the imposing, self-assured figure of Yeager, played broodingly by Sam Shepard, leads his independent life-at-the-limit. The obvious question is, if Yeager was such a flying ace, why was he not selected, not even considered, for astronaut training? The answer's simple. Yeager had enlisted in the Army air force in 1941 at the age of 18. Only six years later, he flew the plane that broke the sound barrier. But he couldn't be considered for astronaut training because he didn't have a college education!





Top: The future Mercury astronauts went through intensive physical tests before being chosen for the American space programme. Above: Sam Shepard as Chuck Yeager rides in on the wing of the X-1 rocket plane on October 14th, 1947, when he became the first man to break the sound barrier in level flight. Left: Brigadier General Charles (Chuck) Yeager, USAF (retired) was technical consulant for the film of The Right Stuff *and also played Fred the bartender in the* Fly Inn. *Photos: © 1983 The Ladd Company.*

Special effects

Although spaceflight is a central theme of the film, it isn't chock-a-block with special effects. That makes the simulation of Glenn's first American orbital flight all the more impressive. Until that point, most of the action had taken place in the atmosphere, in the X-1.

The Right Stuff attempts to cover a great deal of material in its 192 minutes running time. By delving into the private lives of the main characters and interweaving their stories with a chronological record of the events, a lot of material from the book has been left out. However, Kaufman's contention that the film should feature the dual themes of Yeager and Mercury, and not dispense with Yeager altogether as Goldman had wished, has, I believe, been proved correct. The relationship between the fliers in both camps is vital to an understanding of the motivation and behaviour of the Mercury astronauts. Without an appreciation of the test pilot fraternity and its traditions, the Mercury Seven might otherwise appear as a rather superficial group of hard-drinking, womanisers (Glenn excepted).

I'm pleased to see Wolfe's book made into a film, but the film didn't recapture the excitement I felt when I read the book. Nevertheless, I found it entertaining, at times amusing, but trying to cram too much into the running time. If you're at all interested in spaceflight, particularly if, like me, you followed the fortunes of the Mercury programme as it happened in the early 1960s, then do go and see the film. It contains some original footage of the first spectacularly unsuccessful attempts to get a rocket into space, and interesting flying sequences with the X-1 and NF-104, which crashed in a horrific accident shortly after Yeager ejected.

He didn't escape unscathed – his ejector seat struck him in mid-air and molten propellant from the seat's rocket motor dribbled inside this smashed helmet, burning furiously in the suit's oxygen environment. Although badly burned and half blinded, Wolfe's book reports that, when the rescue helicopter arrived, Yeager was standing in the desert waiting for it with his parachute neatly rolled up and the remains of his helmet tucked into the crook of his arm – straight out of the manual. Astronaut or no, Yeager displayed the essence of *The Right Stuff.*

The Right Stuff is distributed by Warner Brothers. The book, *The Right Stuff,* by Tom Wolfe is published by Jonathan Cape in hardback and Corgi (Bantam Books) in paperback.

THE BELGARIAD

By DAVID EDDINGS

IN CORGI PAPERBACK

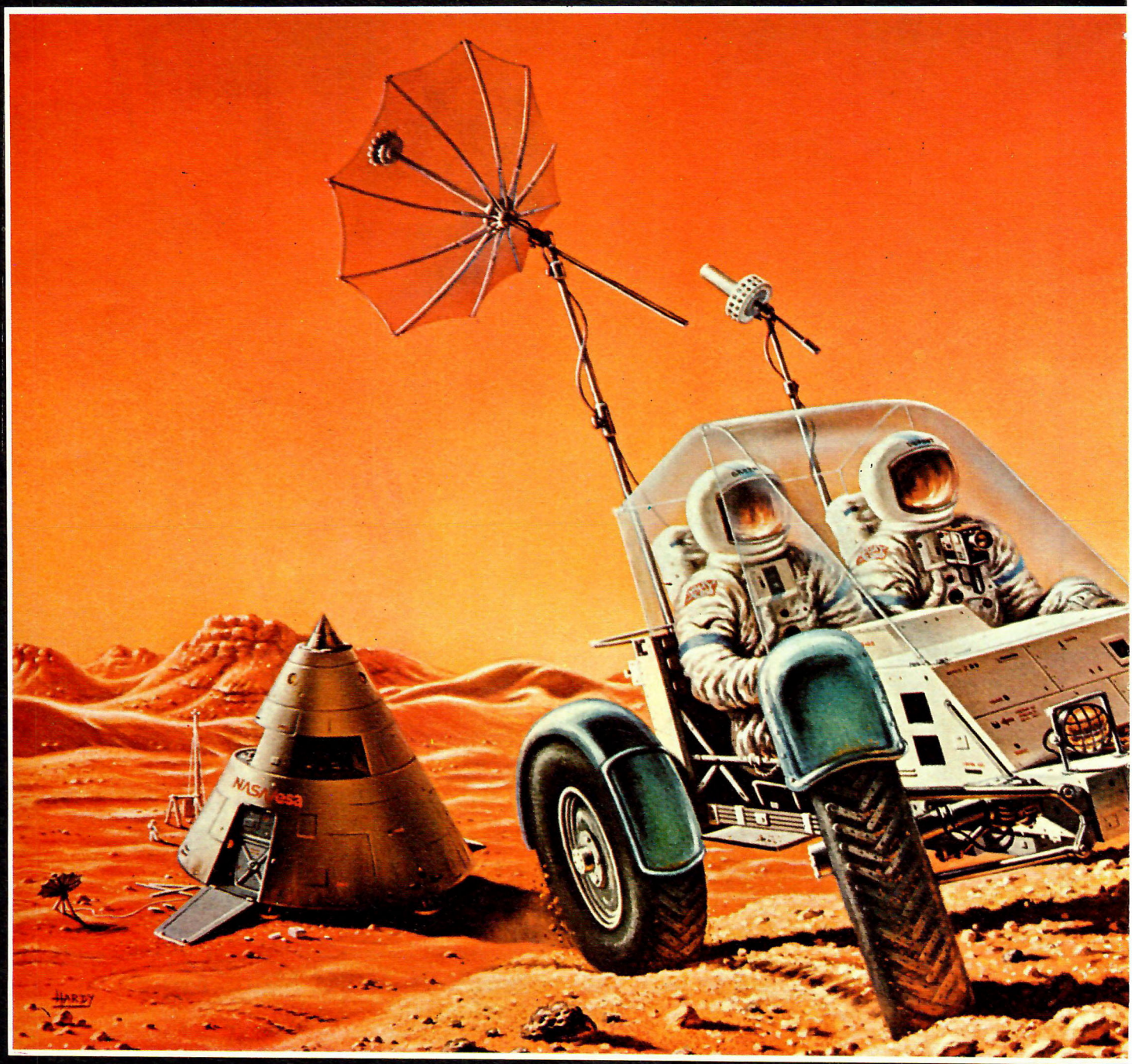
COMING 25th MAY

Book Four to be published September 21st 1984

A MAGNIFICENT FIVE VOLUME EPIC OF IMMENSE SCOPE SET AGAINST A HISTORY OF SEVEN THOUSAND YEARS OF THE STRUGGLES OF GODS AND KINGS AND MEN – OF STRANGE LANDS AND EVENTS – OF FATE AND A PROPHECY THAT MUST BE FULFILLED!

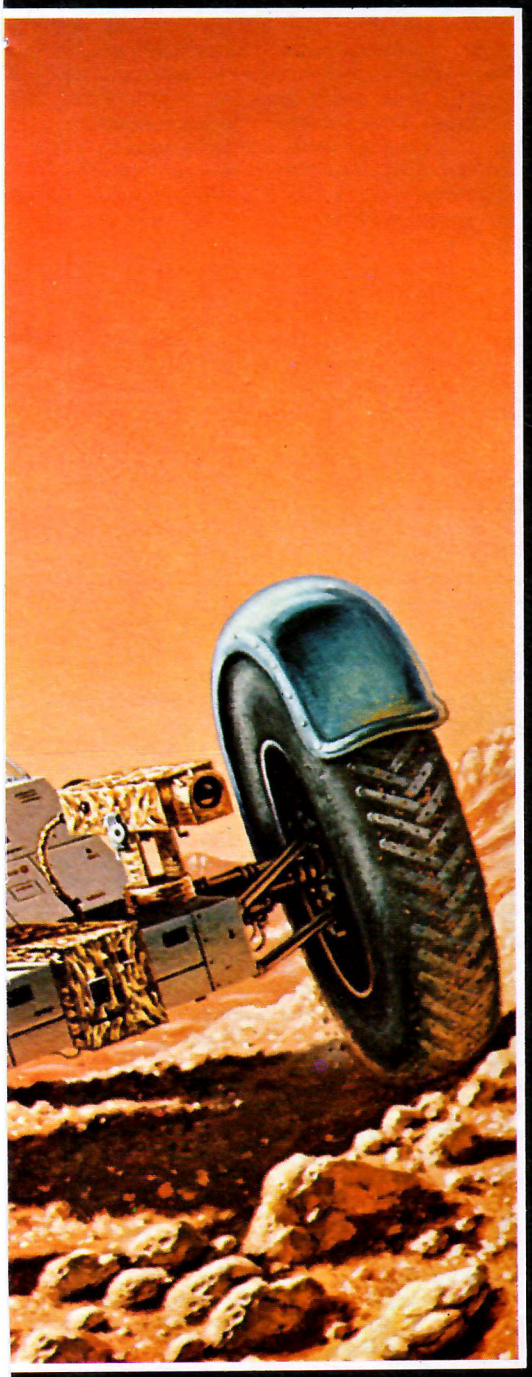
"They're *good*! In fact, they're fabulous. More! More! More!"
ANNE McCAFFREY

MANNED MARS EXPLORATION



THE PLANETS OF OUR SOLAR SYSTEM CONTINUE TO BE SURVEYED BY ROBOT EXPLORERS, BUT ONE DAY HUMAN BEINGS WILL SET FOOT ON THE RED PLANET.

TEXT AND PAINTINGS BY DAVID HARDY.



Yes, there is life on Mars. That would most probably have been your opinion, in the first half of this century. Even Arthur C Clarke was able to write about small, kangaroo-like Martians in *The Sands of Mars,* published in 1951. After all, Mars, although smaller than Earth, has the same land-area, an atmosphere, and a roughly 24-hour day. And it has, in addition to the reddish desert areas that earned Mars its nickname 'The Red Planet', dark areas which appear to spread as the white polar caps shrink – and what about those canals?

It was in 1877 that Giovanni Schiaparelli, director of Milan Observatory, first claimed to see dark streaks which he called *canali,* meaning channels, on Mars. A wealthy astronomer from Boston, Percival Lowell, took up the cause of the canals, as they quickly become known, and drew hundreds of them at his observatory high on Mars Hill in Flagstaff, Arizona. He announced in 1894 that they were *artificial* water-courses constructed by intelligent creatures to carry water from the melting poles to irrigate their dry and dying planet.

In 1898 H G Wells' *The War of the Worlds* appeared. In it, highly aggressive Martians attack Earth in search of a new home, and it was the first of many such stories, books and films to populate Mars with intelligent life, in a variety of weird and wonderful guises. Radio was not immune either: in 1938 Orson Welles threw the USA into a state of panic with a documentary-style broadcast of Wells' story.

One boy who read a serialised version of *The War of the Worlds* (like Lowell, he was from Boston) was Robert Goddard. In 1926 he fired the most successful liquid-fuel rocket – and only 50 years later Viking landed on Mars, using liquid-fuel retros, and the legend of canals, and life, on Mars was apparently put to rest for ever.

Of course, the Viking landers had to sit in

Left: The Lander (left) has touched down using a combination of aerodynamic and rocket braking; a large communications antenna has been set up, and a drilling rig erected. Two astronauts make an early morning start in their Mars Rover to explore the local hills. (From Atlas of the Solar System *by David A. Hardy, © 1982). Above: Exploring the Martian polar cap. The red-ochre ground is covered with a white deposit – water ice, perhaps with some CO_2 'dry ice'. In the foreground an astronaut collects rock samples, while his colleague takes off on a 'flying platform' for longer-range exploration. (From* New Challenge of the Stars *by Patrick Moore and David A. Hardy, © 1978.)*

one spot. Just over the horizon there *might* be one of Ray Bradbury's crystal cities. For that matter, a few metres beyond the reach of Viking's sampling arm there might lie buried the bones of one of Edgar Rice Burroughs' red, green or black 'Barsoomians'. But it must be admitted that either eventuality is highly unlikely! Even so, we still cannot rule out the possibility of life on Mars – be it only a humble bacterium – until we have examined a *lot* more of its surface.

There are excellent reasons for the USA, in particular, to orientate its flagging space programme in the direction of Mars. President Reagan's science adviser, George Keyworth, suggested in 1983 that it is time for the US to think about new directions as ambitious and daring as was Apollo .... A manned expedition, or better still a base on Mars would provide a worthwhile and much needed long-term goal. The recently-announced space station might be a first step in this direction.

Before Apollo astronauts could step upon the Moon a whole arsenal of unmanned hardware was sent to reconnoitre and seek out the best landing sites. In the case of Mars, the programme of automated probes might look like this:

Mars Polar Orbiter: Similar to VOIR – Venus Orbiting Imaging Radar – this would provide a complete map of Mars' atmospheric, magnetic, geological and geochemical properties, at fairly low cost.

Mars Penetrators: Fired from orbiters at strategic targets all over the surface of Mars, these would bury themselves deep in the Martian 'soil' or regolith and relay vital information back to Earth via orbiters.

The 'Flying Squad': From circling motherships, up to 12 computer-controlled aircraft would be released at an altitude of some 500 km, each inside a protective aeroshell. Less than 10 km from the surface, parachutes would brake the aeroshell and the craft would fly free under its own power. Obviously, in an atmosphere consisting mainly of carbon dioxide a normal internal-combustion engine cannot be used; nuclear or solar electric power is a possibility, but a piston engine powered by hydrazine has been tested by NASA with some success. Because of the thin atmosphere a large wing area will be necessary, though the low gravity will compensate somewhat. A range of 5-10 000 km at a maximum altitude of 15 km for each aircraft is feasible.

Automated Mars Rover: Somewhat resembling a Viking on tracks or wheels, this vehicle would travel for a total of 100 km over a period of 90 days 'lifetime', sensing and sampling as it goes and deploying scientific packages at pre-selected sites.

Sample Return: An approach used by Soviet craft to return lunear samples. The vehicle would collect soil and rocks and return them to Earth for analysis, dating, etc in a sealed, rocket-propelled container.

The last suggestion is the most complicated – and of course the most expensive. The whole mission could be aborted by a bad landing, and those who remember Neil Armstrong's nail-biting last-minute change of landing site to avoid nasty-looking boulders will appreciate the value of a manned approach. Even more expensive, true, but in eventual scientific value – as well as public interest – ultimately worthwhile.

After all, only the Orbiter and Penetrator unmanned missions would be strictly necessary as preliminaries if we could set up a manned settlement on Mars. No matter how sophisticated automated probes and vehicles become, they are only tools to extend the brains and limbs of the scientists who design and operate them. But if those scientists could take their senses, arms and legs directly to Mars, they could explore a given area far more thoroughly, in more detail, and 100 to 1000 times faster than a roving machine remotely controlled from Earth. Imagine, too, a rover about to plunge over the edge of a canyon; with a signal taking minutes to reach Earth and return with instructions – too late to avoid catastrophe!

Yet totally autonomous machines, programmed to make their own decisions, will never be able to cope with the unexpected in the same way as a trained human observer. Human technicians could perform with ease tasks which 'robots' would find far from simple, despite hundreds of man-hours spent on Earth instilling instructions to cope with any possible foreseen circumstance. Astronauts could, for instance, drive rovers for long distances, capturing on film or video tape only the significant (not random and inconsequential) features they encounter, because they would be able to evaluate these as they go. They could launch balloons or sounding rockets into the Martian upper atmosphere and recover the scientific instruments (possibly for re-use), or drill over 100 metres deep into the Martian crust, whereas current designs for automated drills provide for only a one-metre core.

Martian expeditions

Today there are many plans, on paper, for manned Martian missions, from the most basic or 'shoestring' to the most ambitious. At a symposium held at the University of Colorado in 1981 it was concluded that the USA could mount a prolonged expedition to Mars in the next 20 years, and that it could cost significantly *less* than the Apollo programme (and remember that this cost less than American women spent on cosmetics in the same period). This is because it would make use of technology and techniques which are already or soon will be in existence, for instance in the Space Shuttle or the planned space station.

Schemes for a Martian expedition are not, of course, new. One of the best-known and most detailed plans was put forward over 30 years ago by Wernher von Braun, first as *Das Marsprojekt* and then in *Colliers* magazine in America and in such books as *The Exploration of Mars,* in which his blueprints were rendered into startling apparent reality by the beautiful paintings of Chesley Bonestell. This grandiose project, in its original form, involved 10 spacecraft and 70 astronauts, though it was later scaled down to two ships and 12 men. Some of the same concepts, including von Braun's wheel-shaped space station and the winged Mars lander, were featured in the George Pal film *The Conquest of Space* (1955) – a film which includes the only pre-Mariner view of Mars with craters known to me (though Bonestell admits that he placed them at the junction of canals more for cinematic than scientific reasons). Von Braun, who later designed the motors for Apollo's Saturn rockets, regarded first the space station and then the Moon base as only the first steps to a Martian base. It may or may not be significant that Soviet philosophy in space seems to follow similar lines, as their concentration over the past decade on space stations suggests.

Modern plans are at least less expensive than those of the 1950's. One of the most interesting was put forward in 1981 by Dr R C (Bob) Parkinson of the British Interplanetary Society, and first appeared in the June 1981 issue of *Analog* (with illustrations which I prepared to accompany it). With the cancellation in 1972 of the NERVA nuclear rocket project initiated by President Kennedy in 1961 (the basis of NASA's design study of 1969 for a 12-man Mars mission), Dr Parkinson proposed using the Heavy Lift version of the Shuttle and the high-energy Orbital Transfer Vehicle, both presently under development, together with ESA's Spacelab as crew compartments, using the 1995 opportunity for an Earth/Mars/Venus swingby/Earth round trip.

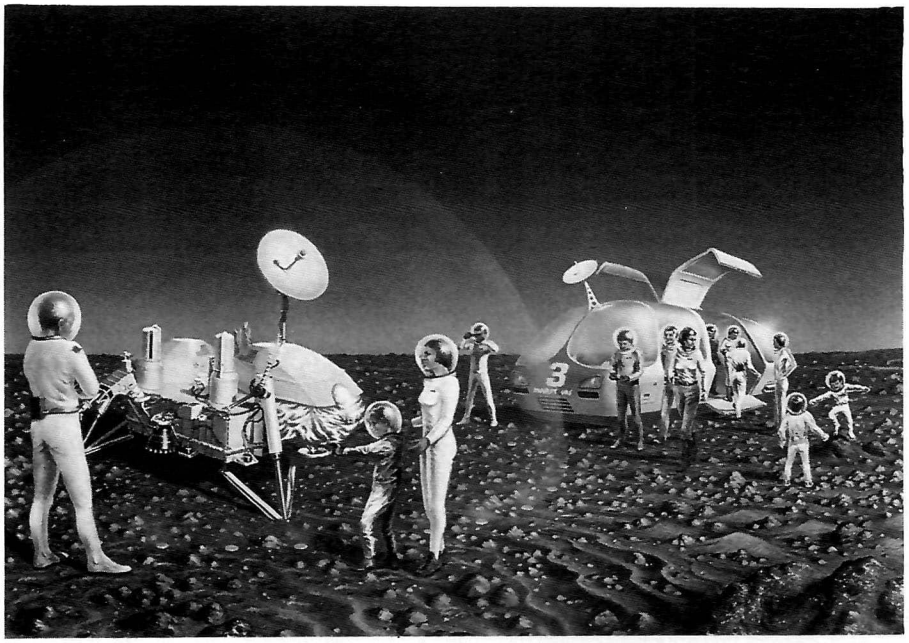
Three vehicles – two Orbiters and one Lander – would leave Earth-orbit in November 1994, using a Heavy Boost State for departure. A smaller stage would allow entry into orbit round Mars. Three members of the crew would land on Mars in a cone-shaped landing module, using parachutes, then on-board rocket engines for a 'hot helicopter' landing; they would spend 20 days on the surface, exploring with the aid of a Mars-rover, as illustrated. The other two crew-members would make a 10-day side trip to the Martian moon Phobos before the return to Earth via Venus, where further observations would be carried out during the fly-by. When in Mars-orbit, a pair of solar panels would be extended and all the orbiting craft would be docked to form one stable cross-shaped assembly.

Because this scheme uses existing or developing hardware (only the Lander and Rover being specifically constructed for the mission – but even these rely heavily on Apollo and Viking experience), its cost need be only four to five times that of the unmanned Viking project; and with the use of Spacelab it would presumably be an international, joint NASA/ESA mission. Yet its value as a scientific (and political) achievement would be many times greater, while the 'spin-off' in many directions could be incalculable.

Make your own fuel

Another method which has been suggested to reduce the mass of a Martian craft, and thus the cost of an expedition, is 'ISPP' (*in situ* propellant production). The idea is to manufacture oxygen on the surface of Mars as a propellant for the return to Earth and it could equally well be used by an unmanned lander, or be applied to rovers or aircraft. The German physicist Hermann Nernst formulated the process upon which this is based – solid electrolysis – around the turn of the century. Carbon dioxide from the atmosphere would be converted into oxygen and stored, releasing carbon monoxide. Assuming the vehicle's fuel to be methane, only one part of this would be required to each four parts of oxygen, so the weight-saving is obvious.

The above example illustrates one of the basic facts about Mars that makes it the most suitable world in the Solar System for human habitation, outside our own. Unlike the Moon (whose only advantage is that it is close), Mars possesses all the materials and resources necessary to make a settlement self-sufficient. Its surface temperature ranges from –80°C at



Tourists spill out of a hover-bus to view, with a mixture of awe, incredulity and amusement, the primitive Viking 1 Lander, still on its original landing site but now protected by an energy dome. A scene which could become reality within the next 100 years. (From* Galactic Tours *by David Hardy and Bob Shaw, © 1981.)

night to 20°C day maximum in summer, whereas the Moon varies from −173°C to 110°C – and Venus boasts 460°C. No water has been discovered on the Moon, but it does exist on Mars in both soil and atmosphere, albeit in small quantities, and there is a great deal locked up in the polar ice caps. Water is essential, both for sustaining human life and as a basic material for rocket fuels and other products.

Martian soil contains 40% oxygen, chemically combined, as well as metallic elements such as iron (largely responsible for the red colour, in its oxides), magnesium and sodium, plus sulphur and chlorine. The atmosphere also contains nitrogen. These mean that fuels, construction materials, soils and fertilizer can be manufactured on the spot. One example is that CO_2 from the atmosphere can react with hydrogen (produced from water by electrolysis) to make methane as fuel. We have already seen that oxygen can be produced; this can be used for breathing as well as for burning fuel.

It has been suggested, notably by Dr Fred Singer, that it would be advisable to set up a manned 'beach-head' on one of the Martian moons, Phobos or Deimos, before descending to the planet itself. From there a team of astronauts could operate remote-controlled rovers or aircraft, ensuring the best choice of landing-site and collecting soil samples. An additional advantage is that Mars would not be contaminated with terrestrial organisms until we are certain that there are no indigenous ones – or Earth with Martian organisms, should they exist. It is increasingly obvious that a sort of symbiosis between human and robotic explorers will be necessary for the setting up of a base on Mars.

Sailing to Mars?

Conventional chemical or nuclear methods of propulsion are by no means the only way to reach Mars. One seemingly exotic yet actually very energy-conscious concept is the solar sail. The basic idea was first proposed by two Russian space enthusiasts, Konstantin Tsiolkovskii (a schoolmaster who also invented the step-rocket) and Fridrikh Tsander around 1920. A very large sheet of reflective material, which today would probably be aluminised plastic film such as Kapton, is propelled by the pressure of photons in sunlight.

At the University of Colorado symposium already mentioned, NASA/JPL engineer Robert Staehle described a Mars expedition consisting of two manned spacecraft, each with four crew and the ability to rescue the crew of the other in case of emergency, making a $1\frac{1}{2}$ to 2-year stay at Mars. The mission involves the use of 14 unmanned Solar Sail Cargo Vessels (SSCV), each similar to the solar sail vehicle which the World Space Foundation plans to launch in 1987, in prototype form. These will tow a total of over 400 tonnes of supplies and equipment, a large proportion of which is propellant and provisions for the return voyage of the crew.

The outward leg of the journey starts at the Space Operations Centre (SOC), the low Earth-orbit station which is assumed to be operational by that time. The SSCVs spiral slowly out, taking four years to arrive in orbit round Mars, carrying everything needed by the crews. Meanwhile, Shuttles carry the other components into Earth-orbit, including two one-way fly-by Mars Transport Craft (MTC) – again a Spacelab long module – and two Mars Aerocapture Vehicles (MAV). The crewed vehicles are propelled by liquid oxygen and hydrogen, with modified Space Shuttle Main Engines for injection into Mars trajectory.

On arrival, the crews assemble a Mars Orbit Station (MOS) in a 3000 km circular orbit accessible to the solar sails. This consists of two separate Earth Return Vehicles (ERV) which were carried by the SSCVs, rotating around a Spacelab hub module at such a speed that Mars-equivalent gravity is produced, both to acclimatise landing crews and for the general health of the orbiting crews. The Mars Landers (ML) are assembled and fuelled, and each crew spends a month or so on the surface before rendezvous with the MOS in an Apollo-like ascent vehicle. At the end of the mission the MOS is despun and disassembled into the ERVs for the return journey; these do not orbit but only fly by Earth in order to release their Earth Entry Vehicles (EEV) for landing. Alternatively they may rendezvous with the SOC and return by Shuttle after a quarantine period.

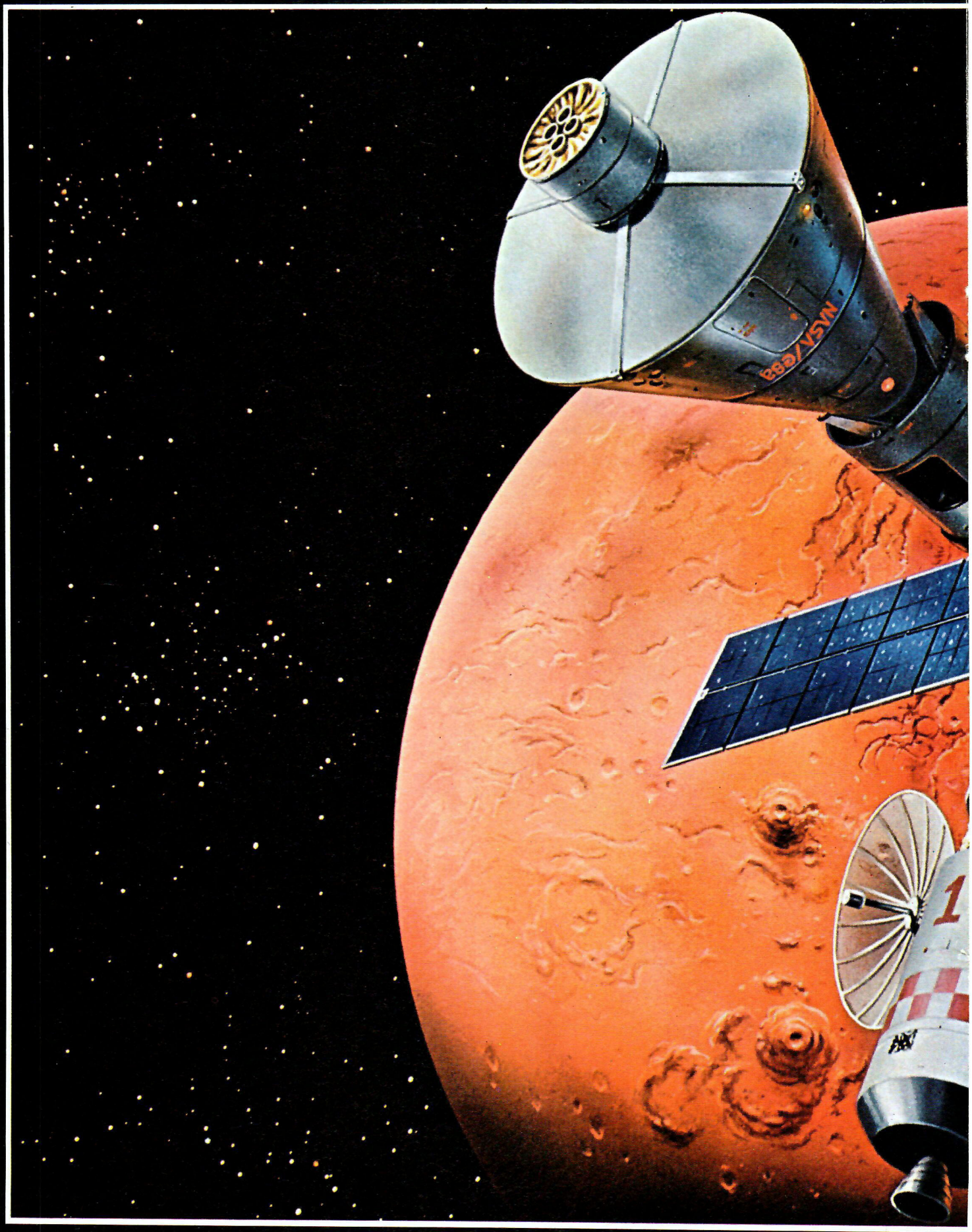
Ion driving

Another type of solar power is SEPS – Solar Electric Propulsion System, or 'ion drive'. This converts solar radiation into electricity which transforms a propellant such as mercury or argon gas into charged particles or ions. These are then accelerated by an electromagnetic field and expelled at high velocity. The total thrust is low compared with chemical rockets, but an ion drive uses only about one-tenth the propellant to produce the same propulsive power. It is worth noting that argon is another constituent of Mars' atmosphere, so there could be another opportunity for mass and cost reduction. The use of argon would also triple the power of SEPS, compared with mercury which could currently allow 2-4 tonnes to be transported to Mars orbit in 6-9 months. The solar panels on a SEPS craft would also continue to generate electricity whilst in Mars orbit, so might even be able to convert this into microwave or laser radiation to beam power down through the thin atmosphere to bases on the surface.

'We have the technology', it would seem. The biggest problems of lengthy manned space trips, as the Russians have discovered, are human. Astronauts must be carefully chosen for their psychological ability to remain stable under difficult and stressful conditions of isolation and confinement. Sufficient scope for recreation and exercise, privacy for individuals, and interesting (not too repetitive) work all help; more problematical are the purely physiological factors of continuous weightlessness, which causes the bones to lose calcium and the heart and muscles to atrophy. The ratio of male to female astronauts is also the subject of study. Hopefully, though, by the time an actual Mars expedition is planned there will have been plenty of opportunity to solve most of the problems and select the right people by long-term testing in space stations near Earth.

Once settlements have been placed on the surface of our neighbour world, and become to a large extent self-supporting, Man will be in a position to initiate Phase Two of his habitation of Mars. Providing that no sign of life has been discovered, the Red Planet can be *terraformed* so that humans can live there without protection – but that subject has already been covered in *Space Voyager* No 5. Either way, there will be life on Mars – ourselves.

Footnote: Bob Parkinson's detailed study, 'A Manned Mars Mission for 1995' appeared in the *Journal of the British Interplanetary Society's SPACE CHRONICLE* in October 1981, and in shorter form in *Spaceflight,* November 1981. Robert Staehle's 'An Expedition to Mars' was published in the January 1983 *Spaceflight.* All are available from the BIS at 27/29 South Lambeth Road, London SW8 1SZ (01-735 3160).


MSAV/e83

The Landing Module pulls away from the assembled Orbiters in Mars-orbit to begin the landing sequence. Living modules based on Spacelab, engine modules and solar panels complete the assembly. © David A. Hardy; proposal by Bob Parkinson.

COMMUNICATIONS BANK

Kits update

I noticed that there is an omission from the list of available kits of X-craft published on page 7 of *Space Voyager* # 6 (Dec/Jan issue). In that boxed article, the X-4 is listed as being available in 1/50 and in 1/48 scale, while the X-5 is listed as being available only in 1/40 scale. It just so happens that I recently received a letter from a fellow modeller in the USA, in which he mentions the existence of BOTH the X-4 and the X-5 in the more popular 1/72 scale. These are vacform kits by Dragon Model Works whose line also includes the Bristol T-188 and the Saunders-Roe SR-41. These kits (at least the X-4/X-5) are available from RVF Imports whose address is: RVF Hobby Imports, PO Box 107, Burbank, California 91503, USA. Alternatively they may also be obtained from: Rarebirds, 113 Midland Avenue, Kearny, New Jersey 07032, USA.

Further information on the X-4 may be obtained in Vol 11, # 2 of the Replica Wrap-Up obtainable as a back issue from: 4415 Newton Street, Torrance, California 90405, USA. Additionally, the X-series is also covered in Aerophile Vol 1, # 2, which is no longer in print, although it might be obtainable via the want ads.

Vancouver, Canada — *Henry Uytengsu Jr*

More SF please

I write to ask if it would be possible to have an article (or perhaps a set of articles) on TV sci-fi that was popular during the sixties and seventies, majoring on shows like: Lost in Space, Land of the Giants, Voyage to the Bottom of the Sea and The Champions.

I'm pleased to see that you're doing an article on Gerry Anderson's later TV venture Terrahawks, but how about something on his earlier creations, particularly Thunderbirds, Fireball XL5 and Stingray.

I have enjoyed reading *Voyager*, but I think you should have a regular spot for popular TV sci-fi, especially Star Trek and Blake's 7, and what happened to your reports on new films and the How to Build The Galactica (promised for Feb '84)?

Horsham, Sussex — *The Wanderer*

Ed: *Yes, I like the idea of a regular* Voyager *spot on television science fiction, and, of course, Gerry Anderson's early productions would be prime candidates for inclusion. As you can imagine, there is constant pressure for more features on Star Trek and Blake's 7. The SF coverage of this issue and the next issue of* Voyager *concentrates on books and movies, so perhaps it is time to return to the small screen. One of the problems is finding a vacant corner in* Space Voyager *to squeeze an extra feature into. At the time of writing, this issue (June/July) is almost at the end of its production cycle, August/September is fully committed and the articles are beginning to arrive, and October/November's contents are in an advanced stage of planning. As for the Battlestar Galactica model, it wasn't possible to implement all of the previous editorial team's plans, but I am trying to include something on Galactica in a future issue concentrating on modelling.*

UFOs? – CDS!

In the UFO Encounters article in issue 8, the Roswell Incident and the early Scully book are mentioned and given some credence. Both these books have been thoroughly discredited and very few UFO researchers give them any credence. Charles Berlitz is best known for his fantasies on The Bermuda Triangle and later The Philadelphia Experiment. The idea that the USA, or any country, has captured UFO fragments or alien occupants, dead or alive, is too stupid for words. Does anyone seriously believe such a secret could be kept under wraps for 35 years?

There is a phrase for this kind of belief; it is the Credulous Dementia Syndrome (CDS). I am afraid that by supporting the idea of crashed UFOs and captured UFOnauts, the authors are merely propagating CDS and are not helping UFO research.

Alsager, Cheshire — *C D Allan*

Ed: *Now there's a natty little insult if ever I saw one – Credulous Dementia Syndrome – can I borrow it?*

Who's Who completed

May I express my thanks and gratitude to whoever was responsible for issuing a long-awaited article. I refer to the *Star Wars* Who's Who. However, although both interesting and informative, may I be indulged in adding a few omissions:

ADMIRAL PIETT
After Admiral Ozzel's demise at the hands of Darth Vader, Captain Piett was promoted to Admiral and given command of Vader's flagship, the Executor in *The Empire Strikes Back*. He continued in this position in *Return of the Jedi* (Kenneth Colley).

BIGGS DARKLIGHTER
Biggs grew up on Tatooine with his best friend Luke Skywalker. Piloted an X-wing fighter in *Star Wars*, but was killed in the final attack on the Death Star.

DEWBACKS
Mammoth lizard-like creatures used as transport by Imperial Stormtroopers on Tatooine. Glimpsed briefly outside the Cantina and on the sand dunes above the escape pod in *Star Wars*.

DROOPE McCOOL
Pale skinned, bulbous bodied flute player in the Max Rebo band.

EMPEROR'S ROYAL GUARD
The emperor's elite personal bodyguard. Clothed in flowing scarlet robes, rounded featureless scarlet helmets and armed with steel javelins.

FX-7
One-eyed, multi-tentacled medical droid who assisted two-one-bee (2-1B) in *Empire Strikes Back*.

GENERAL MADINE
Rebel general responsible for briefing rebel troops before despatching them to Endor (Dermot Crawley).

MOFF JERJERROD
The Imperial officer in charge of supervising construction of the new Death Star in *Return of the Jedi* (Michael Pennington).

MON MOTHMA
Stern but beautiful leader of the rebel alliance in *Return of the Jedi* (Caroline Blakiston).

POWER DROID
Squat, two-legged cube shaped droid seen in *Star Wars*.

TWO-ONE-BEE (2-1B)
Surgeon Droid in *Empire Strikes Back*, which fitted Luke Skywalker's artificial hand.

WEDGE ANTILLES
One of the few surviving pilots of the Death Star battle in *Star Wars*. Flew a snow speeder in *Empire Strikes Back* and accompanied Lando Calrissian into the reactor shaft in *Return of the Jedi* (Dennis Lawson).

WICKET
A tiny Ewok warrior who found the unconscious Princess Leia after she had been knocked from her speeder bike in *Return of the Jedi* (Warwick Davis)

4-LOM
Insect-like bounty hunter employed by Darth Vader to capture the rebel leaders in *Empire Strikes Back*.

Apart from these omissions, you also had a couple of misprints; MAX REBO was incorrectly spelt and Darth Vader's TIE fighter and the standard TIE fighter headings were reversed.

Forest Hill, London — *Mark Smart*

Ed: *I've received lots of letters pointing out the TIE fighter confusion and identifying one or two omissions, but Mark Smart's letter was by far the most comprehensive (and legible) contribution. Surely there can't be any more* Star Wars *characters lurking in the shadows waiting to be discovered by a* Space Voyager *reader! Incidentally, Dennis Lawson (Wedge Antilles) has, I am reliably (I hope) informed, appeared in every* Star Wars *film to date, albeit fleetingly.* Space Voyager's *principal American correspondents, Randy and Jean-Marc Lofficier, managed to track him down recently. Look out for an interview feature in the near future.*

Modelling advice please

Having just found *Space Voyager* and started to catch up on back issues I want to congratulate you on the magazine – it works!

Most of all, thank you for continuing to feature Blake's 7. The series is a remarkable success, especially as interest in B7 still thrives in spite of the orthodox media.

I agree with Mrs E March (Comm Bank issue no 7) on the importance of Servalan, but I was not able to 'sense her gloating somewhere behind the set'. One of my many complaints against the 'Blake' episode is that at no time was there any indication that Servalan was behind the Gauda Prime trap, she was apparently totally ignored.

I was impressed with Wendy Ingle's model of the Saurian Major encounter, and hope to see more B7 related articles in forthcoming *Space Voyager* issues. It would be interesting (and helpful) to have advice about modelling from scratch as there are no kits available to B7 fans.

Hereford — *Ann Godfrey*

Ed: *I'm sure that Wendy Ingle will be pleased to read your comments, especially as they echo those of many other readers.*

PUBLISHERS' NOTE: The editor reserves the right to shorten letters for publication; opinions expressed by readers are not necessarily those of either the editor or publisher. .

Puppeteer history

I am writing to you regarding a letter by Steve Cassidy in your February/March issue concerning the history of Pierson Puppeteers. In his letter, Mr Cassidy states that the Puppeteers' home planet was removed from orbit around the present star in order to dissipate waste heat.

Although the planet was at one stage removed to a distance of 1/10 light years from the star to dissipate heat and also to avoid extinction when the present star exploded to become a red giant, it was not until several millenia later that the planet was removed completely from the star system. This was done after a puppeteer research vessel discovered a supernova chain event had occurred in the case of the galaxy 10 000 years previously and it was deduced that the high energy radiation would strike the home system in 20,000 years.

Upon discovering this, the Puppeteers took their home planet and four agricultural planets and headed out of the galaxy to seek refuge in the Magellanic Clouds, the journey will take approximately 85,000 years as they are travelling at sub-light speeds (they're afraid of hyper-space).

For an account of their history and journey and a description of their home world, see chapters five and six of Ringworld.

Greenhills *William Butler*
Dublin

Alien concepts

The article in issue number 7 entitled 'Spaceships of the Mind' by Jenny Randles was extremely interesting. She has obviously studied the phenomenon of UFOs very closely, but there's one aspect of her theory that I can't quite come to terms with.

She states that the victims use images and concepts of aliens found in their own memory stores to act out the encounter. Surely, then, in the case of a multi-witness encounter, each witness would see totally different images in totally different areas of the sky. For, each and every one of us has independent ideas of what aliens and their craft would look like – even though everybody has been to see *ET!*

Have you ever considered, or if you're ever likely to consider, publishing short sci-fi stories? If not, do you know of any British publications that do print such stories, as I have been unable to trace any myself.

Hinckley *Tim Robinson*
Leics

Ed: *By coincidence,* Space Voyager *will indeed shortly be publishing science fiction short stories. For the moment, though* Space Voyager *will concentrate on writer's who have already been published, but a little later on, there are plans on the stocks to publish stories by new writers. Watch these pages for an announcement.*

Where's Ray?

Although your magazine tries to cater for all demands in space and fantasy, it is lacking in one respect.

Where is Ray Harryhausen?

Not once in *Voyager* have you ever mentioned the greatest special effects man to ever put his work on celluloid. Where is he? Why have you neglected to mention him?

I am sure that an interview or a feature on this great animator will not go unnoticed by your readers. After all, if it were not for Ray Harryhausen, there may not have been a *Star Wars* or many of the big special effects oriented films which have become so popular these days. Perhaps a many issued feature on the history of fantasy special effects would be a good idea. This way most of the great special effects men could be included, including Ray Harryhausen.

Telford *K E Gardner*
Salop

Ed: *The many serried ranks of editorial staff at* Space Voyager *stand with bowed heads and quill pens glinting in the noon-day Sun, suitably admonished for this unthinkable lapse in coverage. A sub will be shot at dawn every press day until the situation is rectified.*

Apologies for the purple prose Mr Gardner. I'm not extracting the Michael. In fact, I'm something of an admirer of Mr Harryhausen's work myself. There simply hasn't been much to wax lyrical or blunt the editorial quill about in this issue's post-bag.

Wendy Graham replies

RE the letters on my interview with Michael Keating. No-one could be keener on a return for Blake's 7 than me, though it doesn't seem likely, at least in what the BBC term 'the foreseeable future'. Maybe if the fans keep up the polite and humorous pressure someone will crack.

As far as repeats are concerned, the BBC is hampered by the contracts made with the actors at the time of filming which mean that the BBC is only allowed one repeat within two years. If they were to show the early Blake's again, it would mean re-negotiating every single contract with every member of the cast, right down to the extras, a task they only undertake, it seems, very rarely and if only one member of the cast says no then it can't be shown.

It seems that ITV is more willing to undertake the re-negotiating – witness the repeats of *The Prisoner* and *The Avengers*, to name but two.

To reader D. Noble . . . Try the publicity department of UIP International, Mortimer House, 37-41 Mortimer Street, London W1A 2JL for your photos of Enterprise mark 2.

To reader J Harley. I quite agree.

Ray Harryhausen with some of the models he made for Clash of the Titans, released on video by MGM/UA. Photo: MGM/UA.

Simon Goodall round two

With reference to the comments on my observations of errors in films by Carol Griffin and the Editor of *Space Voyager* (indirectly) I would like to defend my opinion.

Films in general have one sole purpose – to entertain and like any other consumer product, should satisfy the 'buyer', ie the cinema-goer. Like any other purchase, if that product, made for public consumption is found by the buyer to be unsatisfactory or faulty in any way it is up to the buyer to tell the manufacturer about the fault with a view to having it corrected. Films can be treated in much the same way.

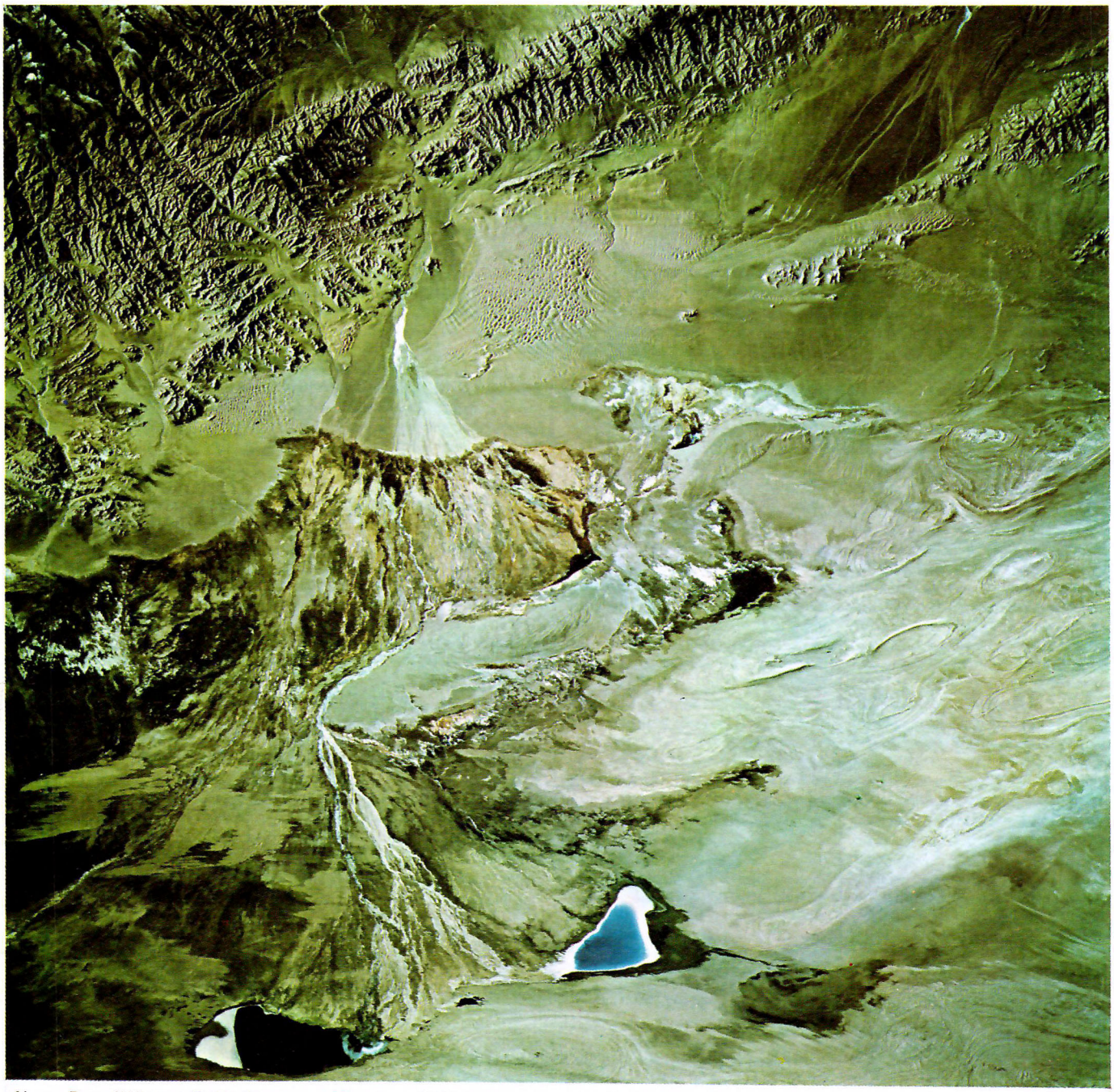
The whole purpose of films is to create an illusion and one that is believable, be it historic, contemporary or futuristic, something to 'take you out of yourself' and into an alternative reality for two hours or so. If, suddenly, the wire supporting a spaceship or blue line glares at you the illusion is immediately shattered, you're brought back to reality in the knowledge that it is only another special effect, it's not real.

It seems somewhat defeatist in objective to spend billions of dollars on a blockbuster only to leave in noticeable mistakes, inevitably marring the overall quality of the film. Constructive criticism makes producers and directors aware of an increasingly discerning audience and the need to strive harder for perfection.

In my view we should be both fans and critics.

Westerham *Simon Goodall*
Kent

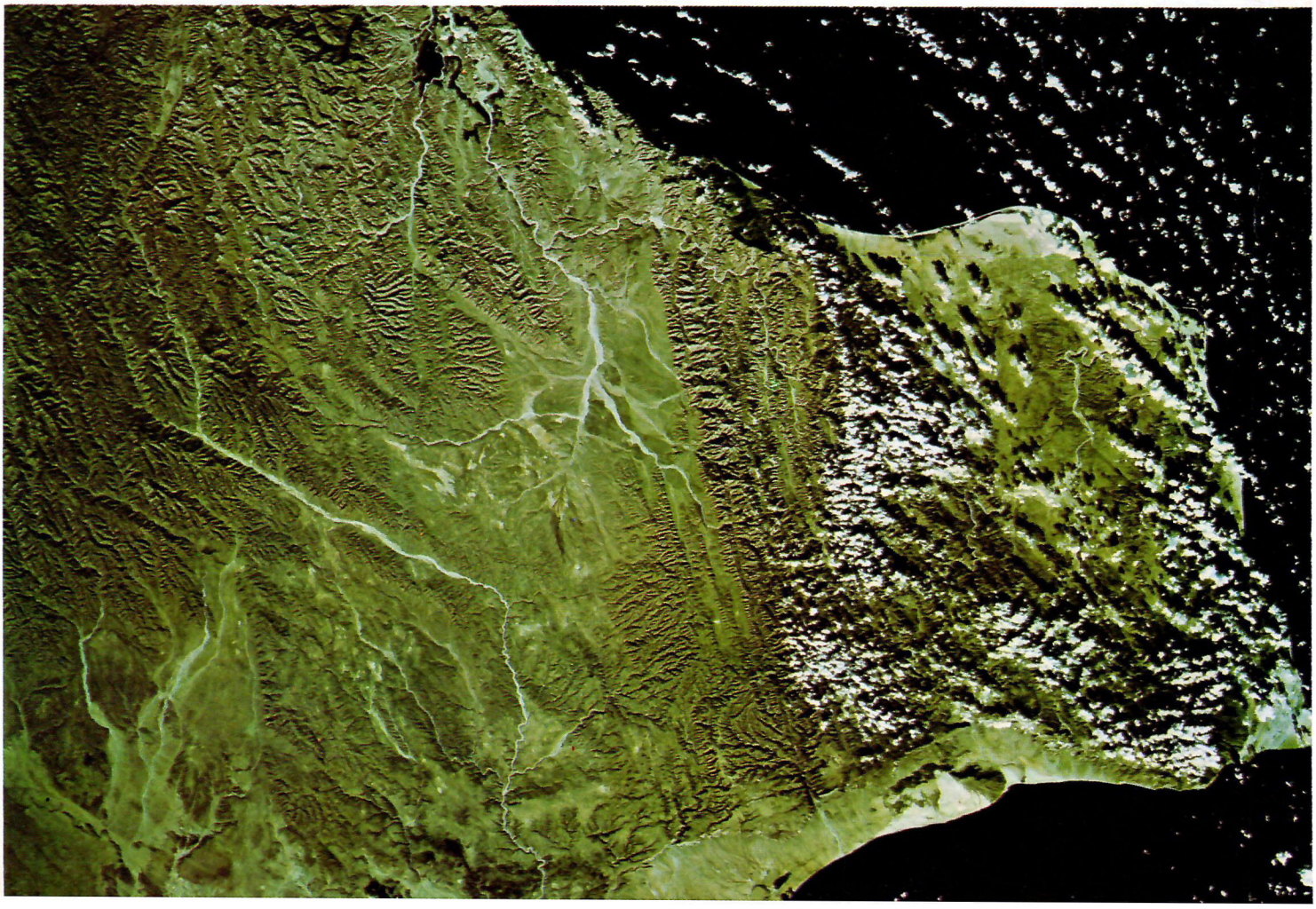
Ed: *Rebuke noted. I'm all for constructive criticism, but it strikes me that some of the cinematic error trapping that goes on is more in the manner of petulant pedantry, picking microscopic holes in perfectly adequate movies. But I can't fault the logic of your argument. I hope a film director who has been the subject of such criticism will write to give his view, but somehow I fancy that they really don't care once it's in the can.*



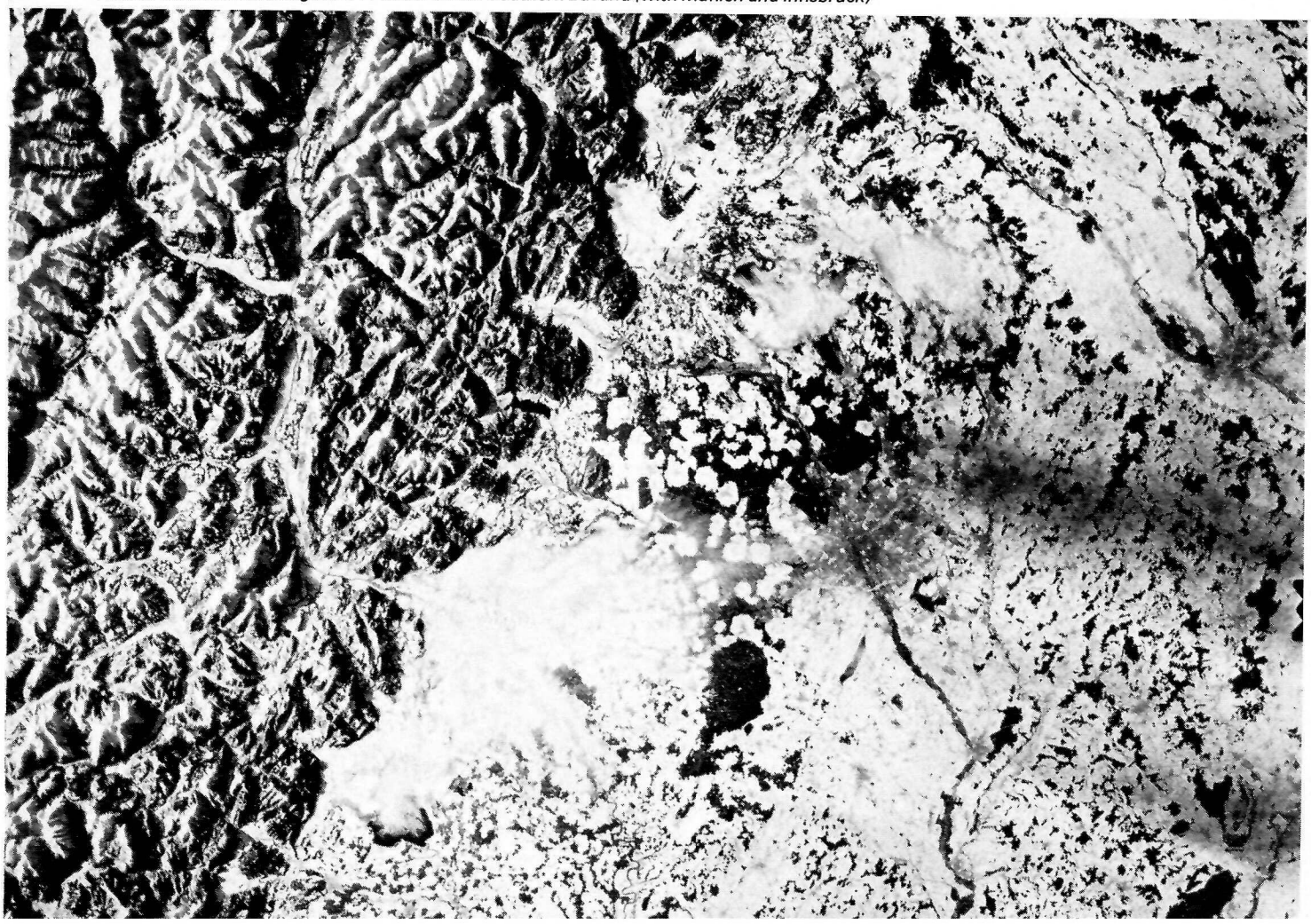
Above: Part of Western China. Above right: The Horn of Africa. Right: Part of Sudan (infra-red film).

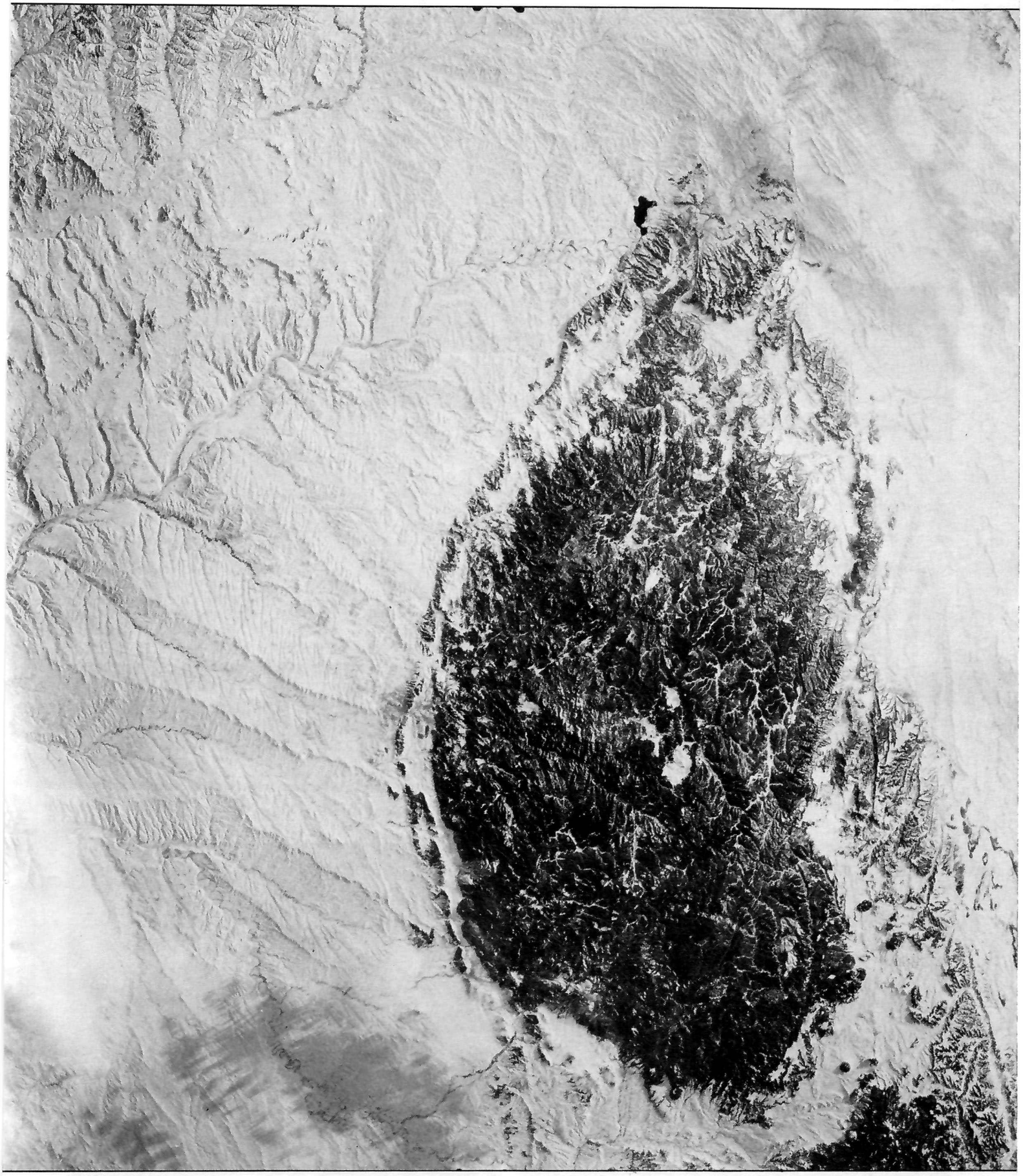
FIRST SPACELAB PICS

ONLY 35% OF THE WORLD'S LAND AREA HAS BEEN MAPPED IN THE LAST HUNDRED YEARS. ONE OF SPACELAB'S MANY EXPERIMENTS WAS DESIGNED TO TEST THE FEASIBILITY OF MAPPING THE REMAINING 65% OF THE LAND AREA OF THE EARTH PHOTOGRAPHICALLY FROM SPACE. A HIGH RESOLUTION METRIC CAMERA, MOUNTED AT THE LABORATORY'S OPTICAL WINDOW, TOOK APPROXIMATELY 1000 EXTREMELY HIGH QUALITY PICTURES. THESE ARE THE FIRST PICTURES TO BE RELEASED.



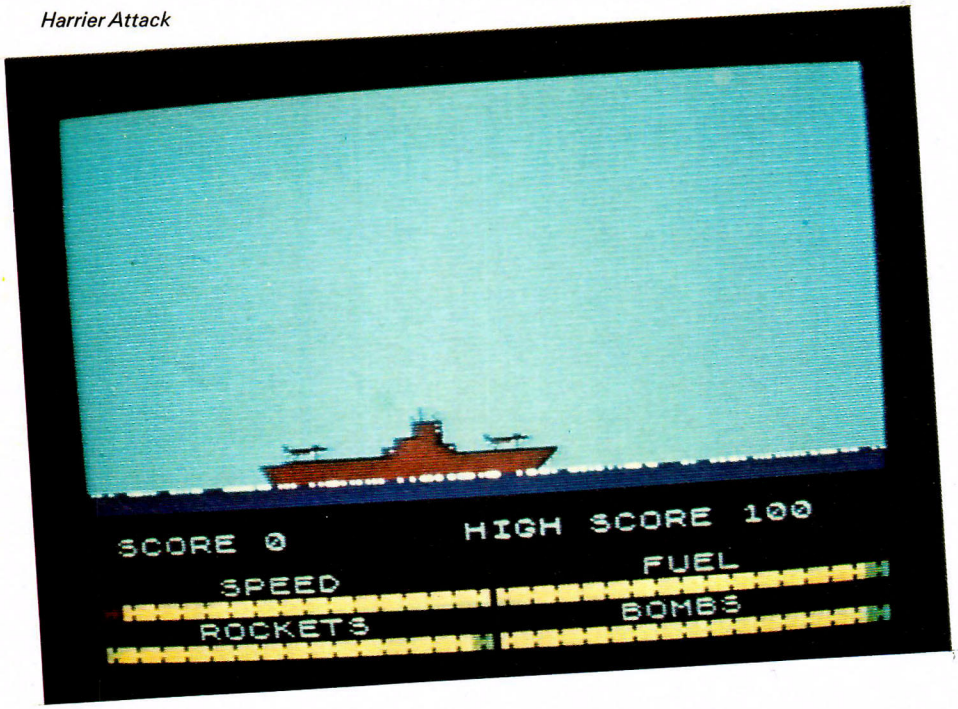
Above: The Marseilles region of France. Below: Southern Bavaria (with Munich and Innsbruck)





The Black Hills, South Dakota, USA.

Harrier Attack



All of the games programs featured in MICRO WARS should be readily available from your High Street software shop or direct from the supplier, whose name, address and telephone number is given at the top of each review. Most of these programs sell for £5 to £10 and unless otherwise stated, they are supplied on tape cassette. Check with the computer specialist press or the suppliers themselves for the up-to-date situation on prices and availability.

Title: Harrier Attack
Micro: Sinclair Spectrum
From: Durrell Software
Castle Lodge
Castle Green
Taunton
Somerset TA1 4AB
Tel: (0823) 54489

Once loaded, this game features very realistic graphics of a pair of Harrier aircraft on its title frame. The aim is to take off in your Harrier from an aircraft carrier and fly on a sortie to an enemy island. Fly too high and you attract the interest of enemy fighters, too low and you run the risk of being hit by flak from ground batteries. You can tackle the aircraft with air to air missiles and the ground radar and batteries with bombs. The aircraft's speed and height are controlled using the Spectrum's cursor control (arrow) keys. There are five skill levels, presenting more and more hazardous missions. Good graphics. A game of lasting interest because of its various skill levels.

Title: Halls of the Things
Micro: Sinclair Spectrum
From: Crystal Computing
2 Ashton Road
East Herrington
Sunderland SR3 3RX
Tel: (061) 205 6603

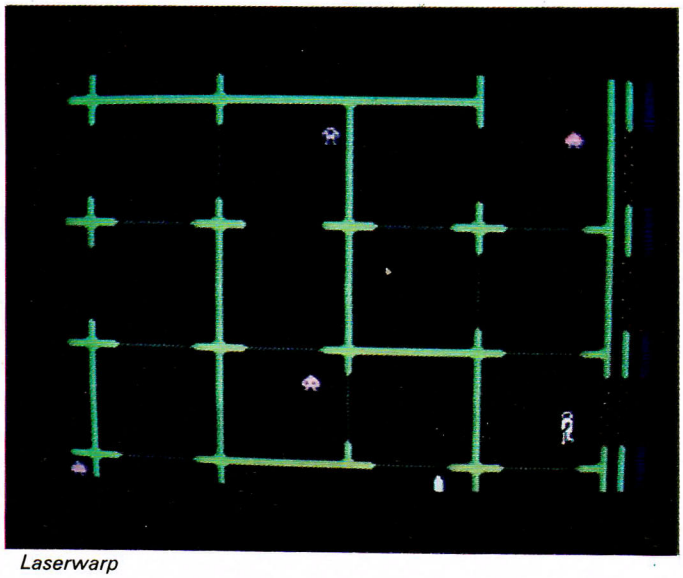
This game is loaded with the instruction LOAD""CODE instead the more usual LOAD"". Don't stop the tape prematurely – the usual yellow and blue stripe load pattern doesn't appear. You enter a rabbit's warren of rooms. The aim is to wander around the hall of things and generally pick up whatever you find. You may be told to look for something in particular – a key, for instance. The 'Things' of the title are spooky little devils which try to bring your life to an early conclusion. They can disguise themselves as the objects that litter the floors of the Hall. To curb their enthusiasm, you can hurl fireballs, bounce lightning around, fire arrows and swing a sword.

Even though there are no sound effects, this is a super game. Every time you play it, it's different, because you never take the same route through the Hall or meet the same obstacles or gremlins twice. The cassette sleeve includes hints and tips on successful playing – a nice package altogether.

MICRO WARS

SPACE GAMES FOR THE SINCLAIR SPECTRUM AND ACORN ELECTRON FROM THE COUNTRY'S FOREMOST SOFTWARE HOUSES. REVIEWED BY IAN GRAHAM

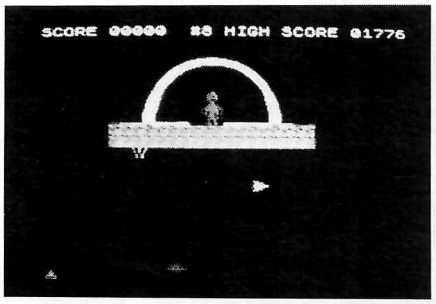
Halls of the Things



Laserwarp

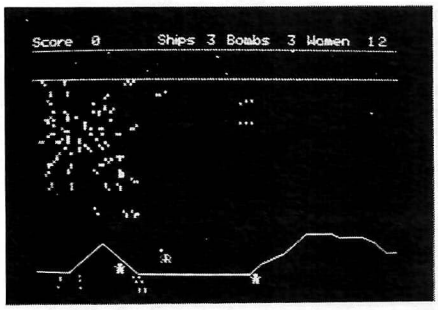
Title: Laserwarp
Micro: Sinclair Spectrum
From: Mikro-Gen
44 The Broadway
Bracknell
Berks
Tel: (0344) 427317

The Master is a fairly Bolshy character. In Laserwarp's cover blurb, he asserts that he's going to destroy you in the same way as he's destroyed all previous challengers to his supremacy. He throws wave after wave of nasties at you. Before every wave, he's considerate enough to warn you of what you should avoid and what you must destroy. Control over your four short and pathetic little lives is by either the keyboard or Kempston joystick. Just in case you feel like giving up after reading the cover blurb and not playing the game at all, the Master, pandering to the human race's innate greed, is offering cash prizes for the highest scores achieved every month. If your score exceeds 5000 points (not a hope!), a code will appear on the screen. Send that code with your score to Mikro-Gen and wait for your cheque (payable to the highest score in each month).



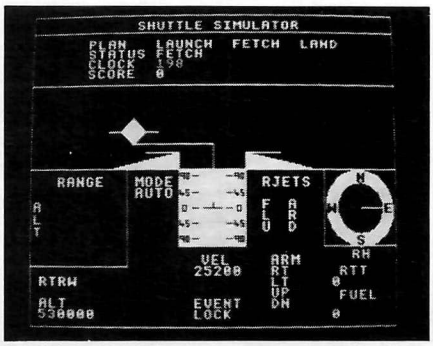
Title: Cyber Zone
Micro: Sinclair Spectrum
From: Crystal Computing
2 Ashton Way
East Herrington
Sunderland SR3 3RX
Tel: (061) 205 6603

The Cyber stands at the top of the screen, master of all it surveys. You must topple it from its spinning spacecraft by chipping away at its floor or hitting its vulnerable spot – its left heel! Keep on the move, though, to avoid the Cyber's diving fighter/bombers and very accurate laser fire. The game, controlled from the keyboard, gets more difficult as it progresses. Selecting a level (1-5) at the beginning determines the level at which you start. Good graphics and sound effects.



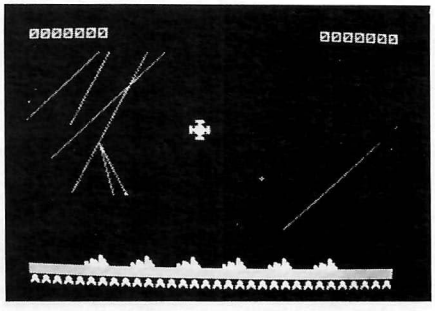
Title: Invasion of the Body Snatchas
Micro: Sinclair Spectrum
From: Crystal Computing
2 Ashton Way
East Herrington
Sunderland SR3 3RX
Tel: (061) 205 6603

While the program is loading, the screen display builds up line by line from the top. Don't stop loading prematurely – the usual Spectrum yellow and blue stripe loading pattern doesn't appear in the screen border. You have to stop the body snatchas snatching bodies. Simple? Not at all. I found it infuriatingly impossible to play this game from the keyboard – you need 16 fingers – well, six actually, but it seems like 16. Fortunately, you can also manoeuvre over the planet's surface making life difficult for the snatchas by using the AGF/Protek, Kempston or Fuller joysticks.



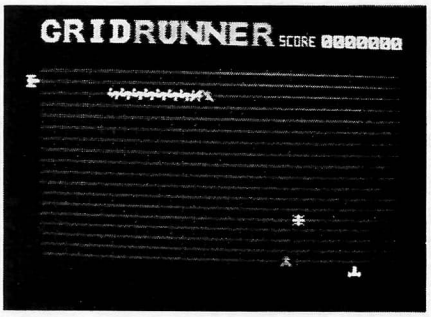
Title: Space Shuttle
Micro: Acorn Electron
From: Microdeal Ltd
41 Truro Road
St Austell
Cornwall PL25 5JE
Tel: (0726) 3456

Space Shuttle gives you the opportunity of a lifetime – you're a Space Shuttle pilot. The aim is to fly a mission to retrieve a satellite from orbit and return it safely to Earth. The mission is divided into three phases – launch, fetch and land. Using thrust and directional controls on the keyboard, you try to aim for the target shown on your plotboard. If you exceed the time limit, the program automatically aborts and jumps to the next mission phase with a suitably disapproving sound and the odd flash of colour. Like Starship Command, Space Shuttle doesn't utilise the Electron's colour potential. Good game, though. A sound off control would be appreciated.



Title: Armageddon
Micro: Sinclair Spectrum
From: Ocean Software Ltd
Ralli Building
Stanley Street
Manchester M3 5FD
Tel:

This program uses LOAD""CODE instead of the usual LOAD"" method of transferring the program from tape to memory. It's very similar to a game that is perhaps better known as missile command. As the name suggests, it's a nuclear war game. You must protect the cities in your area by blowing up the incoming nuclear missiles, thus avoiding the Armageddon of the title. You can do that by moving a sight around the screen and placing it in the path of each missile. When you hit the fire button, one of your own interceptor missiles is despatched to that point and detonated. Of course, there's a time lag between firing and the detonation. So, if you place your sight too close to the enemy missile, it may have passed by before your interceptor explodes. The missiles are accompanied by a very good ominous sound effect. I've played this type of game on other computers when the speed of the missiles and sight was a little faster and it wasn't so enjoyable to play. This one's just about right for me and the sight can be controlled very easily from the keyboard. If you prefer to use joysticks, Armageddon is compatible with the Kempston joystick.



Title: Gridrunner
Micro: Sinclair Spectrum
From: Salamander Software
Quicksilva Ltd
Palmerston Park House
13 Palmerston Road
Southampton SO1 1LL
Tel: (0703) 20169

You're trapped in a graph paper world of horizontal and vertical tracks along which an ominous and very fast-moving 'thing' scans from side to side, gradually moving towards you. Every time you hit it with your blaster, it splits up into lots of gremlins racing around trying to run you down. To make things more difficult, you must avoid the laser bases moving along the edges of the screen firing into the grid. A fast game, making good use of graphics to form the grid, but it was marred by incorrect instructions. The cassette sleeve states that the game runs itself and provides its own instructions – not the version I had. A correction sheet supplied by Quicksilva was also incorrect. In the end, I discovered how to control the game by trial and error. If you're in the same boat, try – O (start and fire), I (left), P (right), Q (up) and A (down).

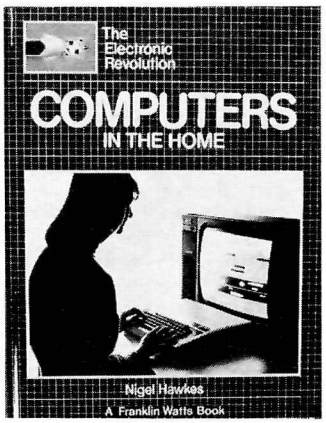
Title: Starship Command
Micro: Acorn Electron
From: Acornsoft Ltd
4a Market Hill
Cambridge CB2 3NJ
Tel: (0223) 316039

You're in command of a starship and you're up against a squadron of attacking alien spaceships. The program gives you very comprehensive control of your craft – rotation to the left and right, forward thrust and braking. The craft is protected against attack by shields, which

Continued on page 74

READ OUT

SCIENCE FACT

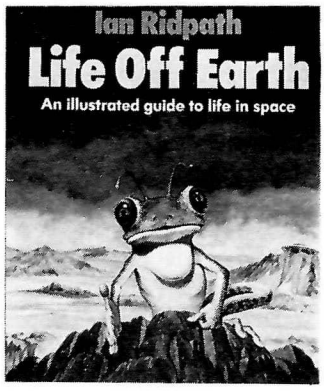


'The Electronic Revolution' series. Published by Franklin Watts at £4.50. Large format Hard covers.

This is a new departure for Franklin Watts, and ideal for that younger brother or sister who wants to know more about the modern world than you can tell them. They are aimed at eight to ten years old, and each contains 28 pages of text, colour photographs and colour sketches. So far there are three titles in the series, *Computers In the Home* by Nigel Hawkes, *Radio & Radar* by Frank Young, and *TV & Video* by Mat Irvine, and there are more titles to come, on Lasers, Satellites and Robots. These are designed for school libraries, but perhaps some imaginative paperback house could bring them out for the poor family pocket. If you are a teacher looking for a school prize, or something to interest that lot who only read Doctor Who books, then try these.

MV

GENERAL

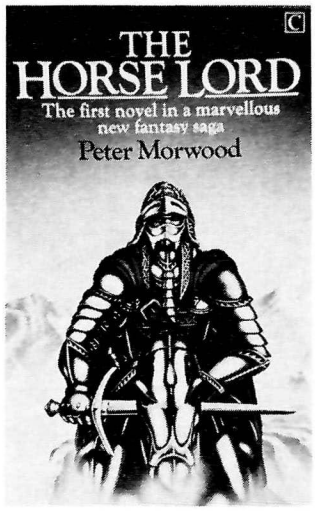


'Life off Earth' by Ian Ridpath. Published by Granada at £5.95. Hard covers.

This is not a textbook, but a popular guide to life in space, meant for both adults and children. Ian Ridpath is a well-known writer and lecturer, and this book is well up to his normally high standard. It covers the first ventures into space, space colonies, the Space Shuttle, then on into the galaxy There are many colour and black and white photographs and also sketches, but this is a not too serious book, as a glance at the cover will tell you. I thoroughly enjoyed it all, especially the chapters on UFOs, and the photographs alone earn it a place on my bookshelves.

MV

SCIENCE FICTION



'The Horse Lord' by Peter Morwood. Published by Century Publishing at £2.50. Soft covers.

This is yet another first novel of a fantasy saga. Aldric, a young Alban warrior, tries to get his revenge from the master sorcerer Kalaar cu Ruruc, aided and in some cases hindered by many of the people around him. There are strange swords, armies of un-dead, a dragon and lots and lots of action. I couldn't put it down.

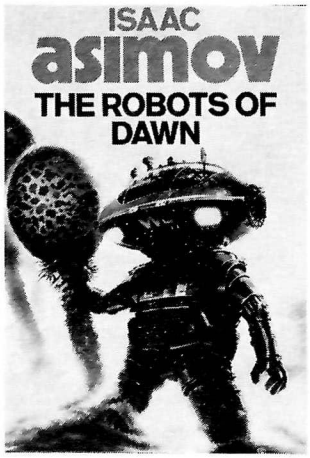
MV

'Judge Child, Book Two' by John Wagner, Mike McMahon and Ron Smith. 'Ro-busters, Book Two' by Pat Mills, Kevin O'Neill and Mike McMahon. Both published by Titan Distributers at £3.50. Large Format Soft covers.

Yet more reprints from 2000AD, Judge Child tells of Judge Dredd's search for the boy with psychic powers that may be needed to save Mega-City from a great disaster.

Ro-busters tells of the robot disaster squad in action. Both are black and white comic-strip format, and in many ways they hark back to the halcyon days of *Dan Dare* and the DC *Mystery in Space.* The drawings are lively, the contents mind-boggling. Would you like to visit strange worlds? Well, they don't come any stranger. Earth after the atomic war is devastated, normal? people live in Mega-Cities, walled off from the areas filled with mutants. The poor robots work hard for mankind, who treat them brutally. They are totally unsuitable for the mundane adults, but children and SF fans adore them, including me.

MV



'The Robots of Dawn' by Isaac Asimov. Published by Granada at £8.95. Hard covers.

In the 1950s Isaac Asimov wrote *The Caves of Steel* and *The Naked Sun,* both still in print in Panther soft covers. This is the sequel at long last, and worth waiting for. Do read the others first, or you will never find out what is going on, but the plot roughly is that a humiform robot has been murdered on another world, and Elijah Bailey is despatched from Earth to find the murderer. He meets Robot Daneel again, and Gladia, and solves the case. Some of Asimov's last books have been a little disappointing, but I found this one well up to his old form.

MV

'Terrahawks' a novelisation by Jack Curtis. Published by Sparrow Books at £1.25. Soft covers.

If you are a Gerry Anderson addict you will have watched the new series *Terrahawks.* It is intended for a younger age-group than the

earlier adventures, but it was surprising how many adults bought this year's Terrahawks Annual for themselves. This is exactly what it says, a novelisaton of the series, with Zelda, Ninestein, Sergeant Zero et al. It doesn't offer anything new, but presumably fans just want the straight stuff.

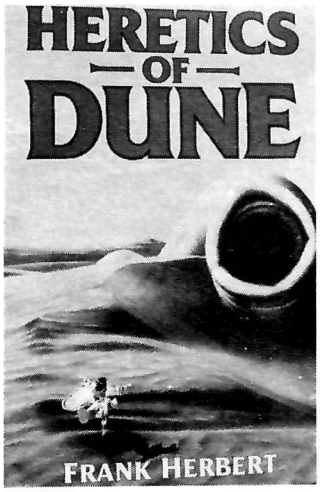
MV

'The Destroyers of Lan-Kern' by Peter Tremayne. Published by Methuen at £1.75. Soft Covers.

This is the sequel to *The Fires of Lan-Kern.* A submarine surfaces to find an apparently empty world, and finally its atomic drive explodes, leaving botanist Frank Dryden alone on the Cornish Peninsula. He makes friends with the strange Celtic tribe of the Lan-Howlek, and settles down with them. In this new book, they discover a remnant of the old races before the holocaust who

have lived underground for generations, but are now emerging to conquer the world. It's the same old tale, but nicely written, and for the Haggard fan onwards, this is the book for you.

MV



'Heretics of Dune' by Frank Herbert. Published by Gollancz at £8.95. Hard covers.

This is the fifth Dune book. Duncan Idaho is still going, so is the Bene Gesserit Order, so are the sand worms, and Rakis is again a desert. Perhaps every author should remember the late C S Lewis's words, when he told his secretary that he would rather be known as the man who wrote too few Narnia books than the man who wrote too many. So, for Dune fans, here is the new book. For non-Dune fans, if you are interested, start with *Dune*. I loved Dune, but have lost interest a little more with each succeeding ramification.

MV

BOOKS PREVIOUSLY REVIEWED NOW IN PAPERBACK

Foundation's Edge by Isaac Asimov. Granada £1.95.
Moreta-Dragon Lady of Pern by Anne MacCaffrey. Corgi £3.95.
2010 by Arthur C Clarke. Granada £1.95.
The Mists of Avalon by Marion Zimmer Bradley. Sphere £2.50.

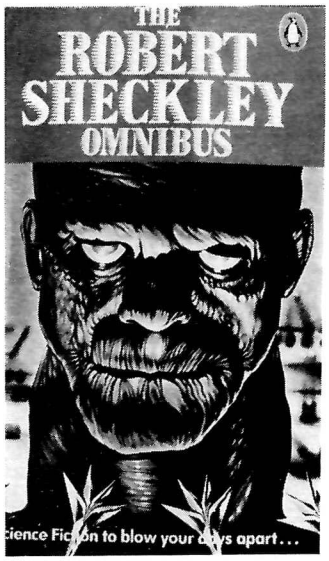
'The Robert Sheckley Omnibus' by Robert Sheckley. Published by Penguin at £2.50. Soft covers.

This was originally published in 1975, and is now reprinted. The contents are worth buying for the novella *Immortality Inc* alone. Thomas Blaine dies in an automobile accident in 1958 and wakes up in a fresh body in 2110. Not only does he have a fresh life, he also has treatment that will allow him to have an afterlife, instead of just dying like most people. He's a very lucky man, one might think.

Or *Bad Medicine* when a homicidal maniac is sold a Martian Regenerator by mistake.

Or *A Ticket to Tranai,* where the government tax collectors don't send you forms to fill, they merely lurk about on dark street corners wearing a black silk mask, hold you up and take your money. After all, on Tranai robbery is the established method of wealth distribution, and not a crime at all. What is more, the President rules by consent of the people, and the women – well, read it for yourself.

Don't forget *The Store of the*

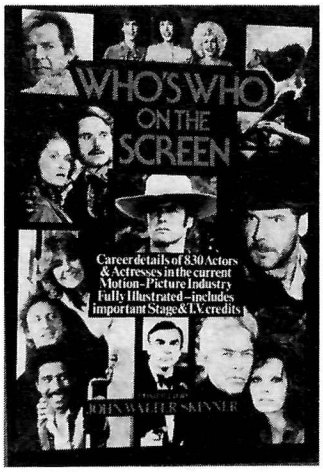


Worlds, a story of the man who wants to fulfil his most secret desires.

But please read *Ghost V* with the Purple-striped Grabber and the Shadower and the Grumbler.

Maybe I'm getting old, but the rest of the books in this issue I enjoyed, on the whole. I had only to read the titles of this reprint to remember the stories, and I don't think that I've reread it in the last eight or nine years, whereas I checked very carefully through the new books in case I got something wrong on first reading. So if you've only £2.50 to spare, buy this book for years of enjoyment.

MV



'Who's Who on the Screen' compiled by John Walter Skinner. Published by Madeleine Productions at £6.95. Large format hard covers.

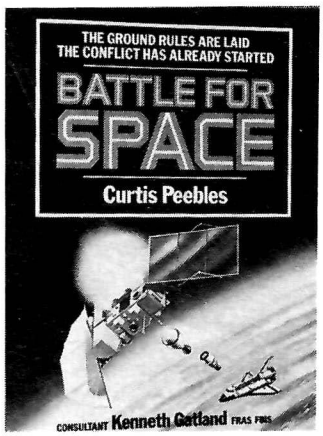
This slim volume is something of a one-man crusade. John Walter Skinner researched the information, selected the entries, obtained all the photographs, did much of the production work, published and distributed his screen Who's Who all on his ownsome. The 127 glossy pages are full of potted biographies of hundreds of television and cinema actors and actresses. Each is accompanied by a black and white photograph. Mr Skinner says that he went through an agonising period of subject selection, trying to decide who to include and who to leave out. There are indeed some interesting omissions – John Wayne, Danny Kay, Jerry Lewis, etc. Although Tom Baker is included, none of the other television Dr Who's is included. I think that is not so much a criticism of the book, but more an illustration of the difficulties, dare I say hazards, encountered when trying to produce a book of this sort to please everyone. No two readers' lists of subjects for inclusion in the book would be the same.

IG

'Battle for Space' by Curtis Peebles. Published by Blandford press at £9.95. Hard covers.

No doubt I will attract some criticism for including this book in Read-out. In an ideal world, we would not need to learn anything about weapons systems from a book like this, because if they had been made (although that in itself seems a ludicrous proposition in an ideal world), one could argue about whether or not to dispose of them by examining principles alone. However, in the real world, I believe that a proposition based purely on principles is sterile in that without force of numbers or similar 'muscle' it has little or no effect on the reality of the situation. I would argue that an understanding of the technology, who controls it, how it operates, the speed at which it responds, is awesome destructive power, how it is being developed and advanced, etc is an asset to making an objective assessment of the situation – political, social or military – whichever side of the armaments fence you choose to sit on.

Curtis Peebles looks to the next horizon and examines the battle for space, that apolitical void that seemed so untainted by our ridiculous Earthly squabbles only a few years ago. Battle for Space is a



very readable guide to the space age arms race. Some of the information given was recently declassified and so you may not have read it anywhere else.

IG

'Worlds Beyond: The Art of Chesley Bonestell' by Frederick C Durant III and Ron Miller. Published by Starblaze Editions (Donning) at $14.95 soft covers, $17.95 hard covers.

Anyone who became interested in space travel during or before the early 1950s cannot fail to have been impressed and entranced by the photographic reality of the illustrations of Chesley Bonestell in books such as *The Conquest of Space* (1950), *Across the Space Frontier* (1952), or *Man on the Moon* (1953); or in the US magazines *Life* and *Colliers,* from the early 1940s. But Bonestell's work continued to appear in books and magazines, and it still does; indeed he is still working, though

READ OUT

mostly for his own amusement, at the age of 96.

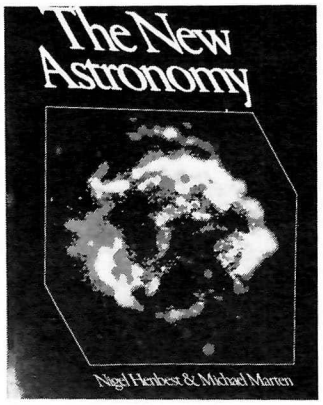
Bonestell (pronounced *'Bahn-uh-stell')* is the indeniable Old Master of Space Art, and his influence on today's 'second generation' astronomical artists cannot be overstated. His work was not confined to paper, for on celluloid it appeared in now-classic George Pal movies: *Destination Moon, When Worlds Collide, War of the Worlds, Conquest of Space* (which owes much more to a later book, *The Exploration of Mars*). Stills and pre-production art from several of these films, as well as others not so readily identified as Bonestell's work, such as *How Green Was My Valley, Citizen Kane* and *Swiss Family Robinson* are included. These reflect Bonestell's training as an architect.

Other surprises for readers who are not already avid collectors are paintings of sailing ships, of The Crucifixion, of the California Missions and of paintings in the Oriental Manner. It is a pity that some famous paintings had to be reproduced so small, and others in only two colours. But others which you may have seen only in black and white appear in their full glory here, so the balance is largely redressed. Some obviously appear dated, but this only adds to their charm. They have their own reality, a magic that transcends time.

In addition to a biography of the artist by art historian Frederick C Durant III and comments on the paintings and techniques by artist Ron Miller, there are tributes by notaries including Poul Anderson, Ben Bova, Hal Clement, Larry Niven and many others.

Worlds Beyond is available direct from Bonestell Space Art, PO Box 15382, Chevy Chase, Maryland 20815, USA, at $15 Surface Mail, $20 Air Mail for the paperback, $18 or $23 respectively for the hardcover. It will no doubt also be imported by the specialist bookshops which advertise in these pages. A set of 40 35mm slides, entitled *Vision of Space* and including many of the illustrations which appear in *Worlds Beyond* and a few which don't, accompanied by a cassette describing them, is available price £12.00 postpaid, from The British Interplanetary Society at 27/29 South Lambeth Road, London SW8 1SZ.

DH



'The New Astronomy' by Nigel Henbest & Michael Marten. Published by Cambridge University Press. Hard covers.

When that well-known *Space Voyager* contributor, Patrick Moore, was a lad (many, many years ago), astronomy was a relatively straightforward affair. It was a matter of gazing skywards through a telescope. Optical astronomy has in recent years been supplemented by studies of the radiation from celestial bodies in other regions of the electromagnetic spectrum – infrared, ultraviolet, radio and X-ray. *The New Astronomy* attempts to bring together all of these different ways of studying the same objects and explore what can be learnt by comparing the images thus obtained. After a brief explanation of the methods of study employed, the book sets off on a most impressive tour of the night sky as you've never seen it before. Each object is shown as it is 'seen' at different wavelengths, so that the different images and the information they convey can be directly compared. A beautiful book.

IG

'The Illustrated Encyclopedia of Space Exploration' by (principally) Richard S Lewis. Published by Salamander at £12.95. Distributed in the UK by Hodder & Stoughton Services.

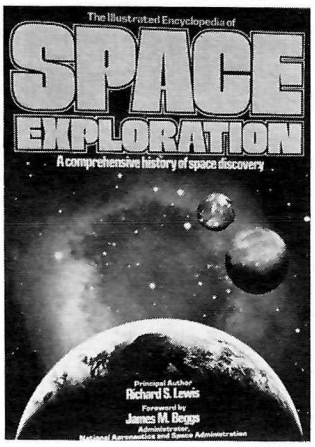
The writers of the publicity blurb that accompanies a new book normally engage in a form of witty hyperbole. They are the estate agents of the book trade. However, in this case, I am somewhat perplexed to find that I agree with the blurb ... so let me quote extracts of it here.

'This stunningly illustrated encyclopedia gives a comprehensive and fully up-to-date account of man's discoveries in space.'

'This fantastic volume is filled with more than 500 colour and black and white photographs, diagrams, charts and graphs ... and 20 superbly detailed colour cutaway drawings of ... spacecraft.'

'A very special feature are 32 double page spreads of some of the finest pictures returned from space – reproduced with breathtaking effect.'

I found the whole book breathtaking, from cover to cover. A beautifully produced, highly illustrated volume, mostly in colour. The subject matter covers everything from the origin of the universe to the origin and structure of the solar system, and on to a preview of the future in space. The section on each planet includes detailed information on the space-

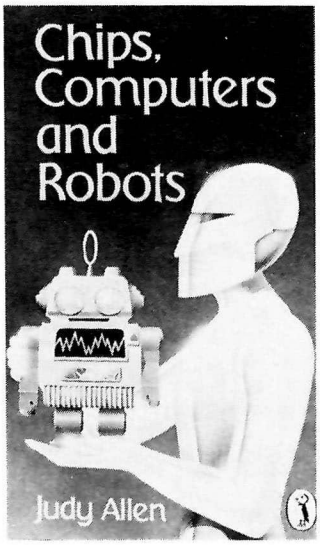


craft that gathered the data on the planet. Hats off to author, designers and illustrators – and of course the publisher for putting up the money to make it possible.

IG

'Chips, Computers and Robots' by Judy Allen. A Puffin book, published by Penguin Books at 95p. Soft covers.

It's difficult to find one of those handy little pocket guides that really tells you what you want to know about something these days. Particularly in the computer field, books seem to be either too technical, or dedicated to a particular computer, or look-and-forget coffee table books. Judy Allen's book packs lots of basic information about micro-



electronics and computers into a compact 95 pages. It's written in everyday English, not computerese. It also covers lots of different topics – microelectronics, making a chip, what is a computer, computer language, the house of the future, teletext and viewdata, robots and artificial intelligence. That's quite a varied contents list for such a slim volume. Aimed at youngsters, this Puffin book can also be recommended to much older readers who may feel at a loss in the face of the inexorable advance of the microchip and are wondering what on Earth it's all about.

IG

REVIEWERS
MV – Marion van der Voort
DH – David Hardy
IG – Ian Graham

One of the book reviewers featured in issue No. 7 (Feb/Mar '84) referred to Henry Kuttner's book 'The Proud Mutant'. This should have read 'The Proud Robot'.

CORGI BELGARIAD COMPETITION

FANTASY BOOKS AND MAPS TO BE WON

WHAT HAS A HISTORY THAT SPANS SEVEN THOUSAND YEARS, INTERWEAVES THE STRUGGLES OF GODS, KINGS AND MEN, AND TELLS OF STRANGE POWERS AND PROPHECIES?

The Belgariad is a five volume epic set in the far off kingdoms of the Alorns and Angaraks. Written by American author David Eddings and published in the UK by Corgi (and in the United States by Ballantine Books), the Belgariad is causing something of a stir in the book world. Corgi quote Anne McCaffrey, an established best-seller fantasy writer, as saying that the books are 'good! In fact, they're fabulous. More! More! More!'

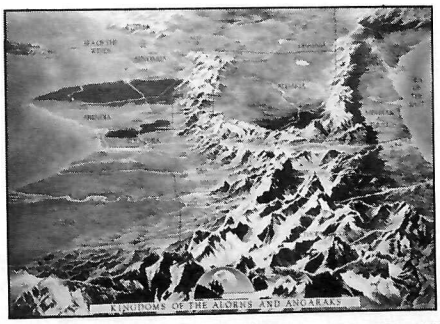
Books one *(Pawn of Prophecy)* and two *(Queen of Sorcery)* are already in the shops, and book three *(Magician's Gambit)* is due to be published on May 25th. Eddings, who has written a contemporary adventure story (his first novel – *High Hunt*) has always been interested in fantasy, and started work on The Belgariad in an attempt 'to develop certain technical and philosophical ideas concerning that genre'.

☆ ☆ ☆

Mapping the Belgariad

The epic adventure is set in the kingdoms of the Alorns and Angaraks. A map of the kingdoms is printed in each book, but of course it's rather small. Corgi have remedied that by publishing a very attractive large format (59 × 42 cm) full colour map of the kingdoms to accompany the books. If you have books one and two of the series, you can win one of these maps by answering a few simple questions about The Belgariad.

If you haven't got the books, you can win a set of the first three titles by doing some philological acrobatics with the series title. And of course there's nothing to stop you trying your luck in both competitions.



Finding your bearings

To find your bearings, you need a copy of the Belgarian map and you can win one by correctly answering the following five questions, using your knowledge of the story.

1. By what name is the character Belgarath first known to Garion?
2. What was the name of the farm where Garion spent his childhood?
3. What is the connection between Aunt Pol and Belgarath?
4. Two of the companions of the quest you are introduced to in Book 1 are Silk and Barak. From which Kingdoms did they come?
5. What is the name of the King of Cherek?

Write your answers on a postcard, add your own name and address, and send your entry to the address given in the rules panel below. The first fifty correct entries drawn out of the editorial hat after the closing date will each receive a print of the map described here.

Booking your series

Now if you don't have books one and two of The Belgariad, you'll find it rather difficult to answer the questions. You could rush out and buy them, or try your luck at winning, not only books one and two, but also the next in the series, book three – *Magician's Gambit*. Three of these sets are up for grabs. All you have to do is stare at **THE BELGARIAD** long and hard and compile a list of words that can be made up from the letters contained therein. People's names are out and each letter may only be used once, but anything else goes, providing it appears in the Collins English Dictionary.

List all your words (neatly, please – typed if possible), on one side only of a sheet (or two or three or . . !) of paper, write the total number of words listed at the top of the first sheet, add your own name and address and send your entry to the address shown in the rules panel, below. The entrants who submit the three highest totals representing lists of allowed words (which will be checked!) will each receive a set of the first three Belgariad books.

RULES

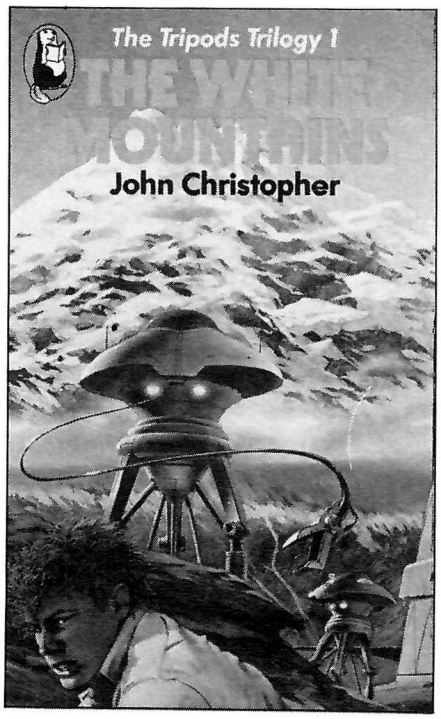
1. Entries should be addressed to:
   Corgi Belgariad competition
   Space Voyager
   Argus Specialist Publications Ltd
   Wolsey House
   Wolsey Road
   Hemel Hempstead
   Herts HP2 4SS
   Entries to both parts of the competition may be sent in the same envelope.
2. The contest will close on July 13th, 1984. The winners will be notified by post.
3. Proof of posting will not be accepted as proof of receipt. Whilst every care will be taken, the publishers of SPACE VOYAGER cannot accept any responsibility for lost entries.
4. The Corgi Belgariad competition is open to UK residents. The staff of ASP Ltd and their relatives, and SPACE VOYAGER's printers, advertisers and contributors are not elligible.
5. The submission of a competition entry implies acceptance of these rules. The editor's decision is final and no correspondence will be entered into.

THE WORLDS OF JO

JOHN FRASER LOOKS BACK ON THE WORK OF SCIENCE FICTION AUTHOR JOHN CHRISTOPHER IN THE RUN-UP TO A MAJOR NEW TELEVISION SERIES – THE TRIPODS ARE COMING!

This autumn sees the start of a major new children's science fiction series on the BBC. In 13 episodes *The Tripods* tells of a time, some 200 years hence, when the earth is ruled by 60 foot, three-legged creatures who possess the awesome power to control the minds of everyone when they reach puberty. How three boys escape the Tripods' grasp and seek refuge with the last free men, forms the plot of this exciting story. You may well recognise it, because it is based on one of the most popular of all science fiction books for children, *The White Mountains* by John Christopher.

Although best known for his juvenile books, John Christopher started out as a writer of adult fiction and had numerous short stories published in American magazines before turning to full length novels. It was with titles such as *The Year of the Comet* (1955) and the even more successful *The Death of Grass* (1956) that his literary career was firmly established. Since 1967, however, he has concentrated solely on children's fiction and is now generally regarded as one of its most distinguished practitioners.



Science fiction, not surprisingly, attracts a substantial proportion of young readers. Ever since the proliferation of the pulp magazines in the early thirties, generations of children have been lured into its ever-widening horizons. After all, the science fiction writer has a wealth of imaginative gadgets and concepts which he can weave into action-packed narratives and so provide a momentary leap into wonder. But unfortunately, the exotic alien landscapes and intergalactic battles of much juvenile fiction are frequently devoid of human interest and are written with an appalling disregard for genuine literary values.

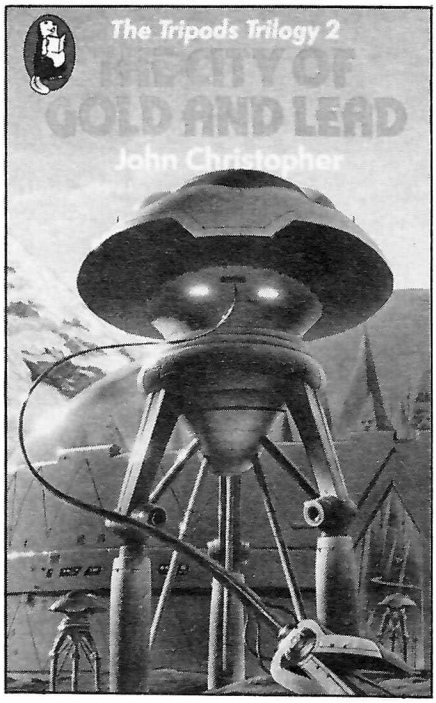
John Christopher, however, shows a good deal more subtlety and depth than the majority of these writers for the juvenile market. While he, too, embraces the traditional and sometimes clichéd creations of popular science fiction, he nevertheless has the ability to transform them into something more lasting and significant. Many of his books are disaster stories in the John Wyndham tradition, though they are often far more terrifying than the cosy catastrophes of *The Day of the Triffids* or *The Kraken Wakes*. The time is invariably the near future; the setting, a world hardly different from our own, except for some disturbance in the natural order.

His earliest book of this type was his second science fiction novel *The Death of Grass* (1956), about the consequences of a mutant virus which destroys all grain-bearing plants. So plausible and logically developed is this scenario that the story hardly reads like science fiction at all. Christopher's restrained prose and natural characters make this a novel of stark realism, so that the reader shares in their desperate struggle against an overwhelmingly hostile environment.

A matter of survival

In his children's novel *Empty World* (1977), a plague sweeps across the continent towards Britain, wiping out most of the population. Only a few young people survive, among them Neil Miller, who witnesses the world around him disintegrating and is forced to cope without the comforts and security which he had always taken for granted. Suddenly he has to make adult decisions; he is confronted with the immense responsibilities of being one of the few remaining inhabitants. Only when he travels to London does he meet other survivors, but even here, it is a continual struggle – and not only to satisfy the immediate needs for food, clothing and shelter. There is also the psychological pressure of fear and loneliness. The book has a haunting quality, with its picture of a deserted London, its acute observation of human nature and its exposure of the vulnerability of Man, despite all his technological progress.

There is, of course, no shortage of global disasters in science fiction, but Christopher's



books appeal as much for their treatment of topical and urgent themes as for their engrossing narrative. Even his most conventional science fiction story, *The Lotus Caves* (1969), which tells of the discovery of life beneath the barren lunar wastes, deals with an issue that is particularly relevant for us today.

The story concerns two boys who set out for a lunar colony to visit First Station, the site where four explorers had apparently perished 70 years previously. The boys' crawler accidently falls through a ravine and into a network of caves, where they find themselves in a strange new world, inhabited by a telepathic plant and one of the members of the ill-fated expedition, who looks no older than he did when he arrived all those years ago.

Although fascinated by the cave system with its enigmatic plant, the boys soon begin to think about returning home. They are faced with an agonising decision: whether to remain there, protected by the plant even from ageing, or return to the restricted lifestyle within the sealed bubble. Eventually, they choose the latter course, knowing as they do so the enormity of the responsibility that would soon be upon them:

'They had discovered something which would excite the whole of mankind; the first alien life, alien intelligence . . . And then? Rock drills ripping through into the living being of the plant? Testing laboratories set up in the lake cave, analysing the fruits that might enable Man to live forever? They would probably try to do as little damage as possible . . . but it would make no difference. The plant had absorbed one irritant and could have absorbed two

JOHN CHRISTOPHER

more. But it could not absorb scientific instruments, all the power and curiosity of Man. Its aeons-long life would gutter away in death.'

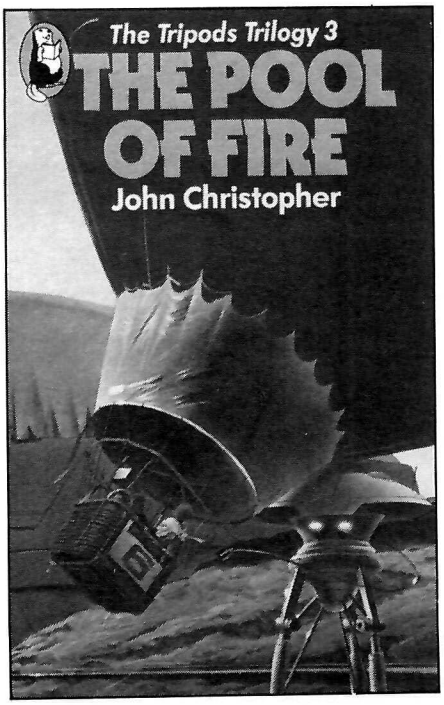
In this book, perhaps more so than in any of his others, the characters have plenty of time to reflect on their situation. The book's pace is relatively slow, but the mystery of this idyllic land is evocatively conveyed, even though the lunar bases and so on may now appear somewhat mundane.

Pessimistic preoccupation

Another favourite theme of Christopher's is that of the totalitarian society and the use of technology to restrict individual freedom. Indeed, the misuse of technology is a constant preoccupation with him. Many of his books are pessimistic about the future, although the best end on a note of ambiguity.

Perhaps the most successful example of this theme is *The Guardians* (1970) which, appropriately, won the Guardian Award for 1971. Britain is divided into two contrasting societies. The workers live in the Conurbs, overcrowded cities with non-stop entertainment and synthetic food; while the gentry live with their servants in the feudal Country, with its *'empty fields stretching to the horizon, shores on which the only sound was the cry of gulls, moors where a man might walk – horrifying thought – for hours and meet no-one.'*

A wire fence separates the two and is supposedly electrified, though this proves to be a rumour designed to discourage people from leaving the Conurb. Most of the inhabitants are quite content with their lot – they are conditioned to be so – except for one Rob Randall, who begins to have serious doubts when a combination of circumstances makes life increasingly difficult for him.



Rob flees into the unknown territory of the Country, where he is befriended by a family who help him settle into a new life. It is not very long, though, before he is discovered by the Guardians, a band of men who police the Country on horseback. During an interrogation session, Rob learns that while the majority of inhabitants accept life without question, those who show any tendency to rebel are treated with a small operation on the brain.

As with many of Christopher's heros, Rob has ultimately to decide between two conflicting courses of action, neither of which is particularly inviting. He may join the Guardians and so retain his freedom, but then he would be compelled to supress the masses. Alternatively, he could return to the regimented lifestyle of the Conurb.

Admittedly, the book brings to mind the dystopian visions of *1984* and *Brave New World* with its disused libraries, loudspeakers booming out *'Are we all happy?'* and the channeliing of aggression into games and the occasional riot. But it ends on a slightly more hopeful note, as Rob decides to continue his struggle against the Guardians.

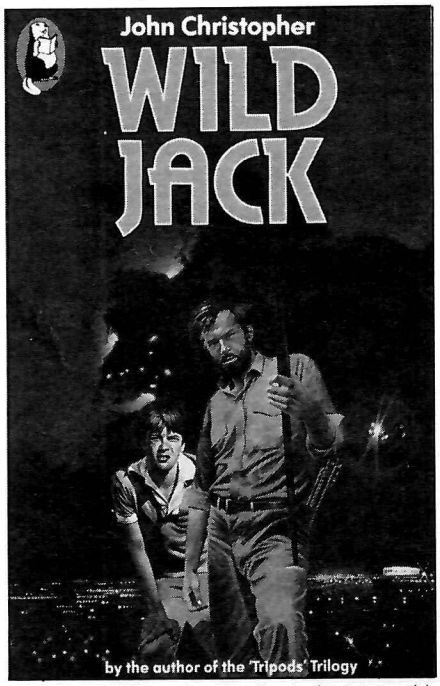
Outlandish worlds

Another book that expresses similar concerns, though perhaps less powerfully is *Wild Jack* (1974), which is set in the 23rd century after Mankind had brought civilisation to the point of collapse for selfishly exploiting the world's energy resources. Now the elite are protected, along with their servants, in walled cities from the Outlands where savages and wild beasts roam. The story deals with a boy, Clive, son of a wealthy Councillor, who is wrongly accussed of anti-social behaviour and is sent to a correction camp on a remote island. Along with a couple of fellow prisoners, he escapes by boat and after a gruelling sea passage manages to reach the mainland. There the boys are captured by Wild Jack, a notorious savage, feared by the city people.

A few days of being a savage himself, far from the luxuries of city life, are quite enough for Clive. He returns to the city, expecting that his father has set matters right. He discovers, instead, that it is his father who is being plotted against by the authorities. Fortunately, while detained in the police building, Clive is rescued by the savages and taken back to the Outlands. This time, he decides, it is for good.

From stories of future technological societies we move to a medieval England of the future and *The Prince in Waiting* trilogy, which comprises *The Prince in Waiting* (1970), *Beyond the Burning Lands* (1971) and *The Sword of the Spirits* (1972).

A fairly complex saga of warring cities and personal conflict, these books are among the most sombre of all John Christopher's writings. The hero, Luke, has been chosen to unite all England and recover the scientific knowledge that was lost when violent earthquakes tore through the land and demolished civilisation. Now a fuedal society has emerged in which technology is banned and superstition thrives. Luke journeys across the smouldering volcanoes of the Burning Lands to the Sanctury of the Seers. The Seers are priests who possess apparently magical powers, but as he soon discovers they do not evoke the spirits but in fact employ the forbidden technology to deceive the people. Finally, Luke uses this newly-acquired knowledge against his own city and it is clear that any so called progress is merely a curse rather than a blessing.



In some respects the trilogy resembles Peter Dickinson's series about the 'Changes', which cause people to turn against machines and enter a new dark age. The stories are, however, quite different although both use science fiction to explore human nature.

To cap it all

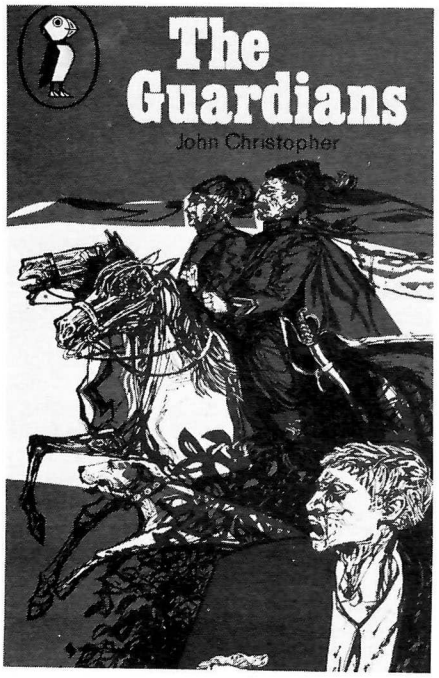
The most popular of all John Christopher's many books is surely *The Tripods* trilogy, the first volume of which is to be serialised on the BBC this autumn. *The White Mountains* (1967) depicts a world in which metal monsters from Mars have invaded Earth and are now the master race. All earth's major cities have been destroyed in the invasion and humanity has reverted to a pre-technological age. The aliens live in huge domed enclosures and police the country in their sixty foot mechanical tripods. To maintain their su-

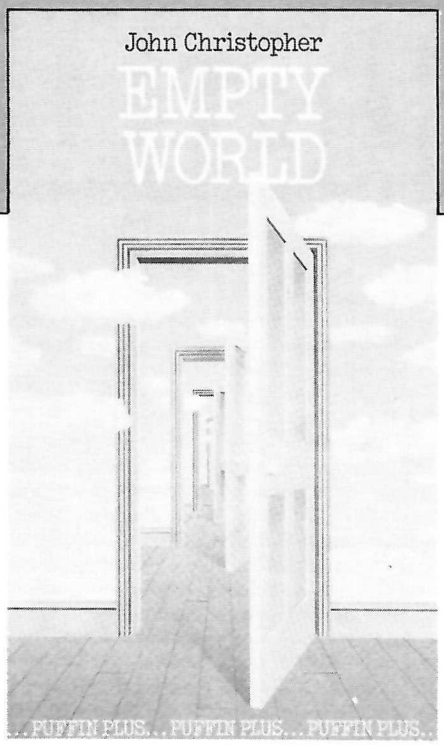
premacy of the humans, they place metal 'caps' on the heads of all children when they reach puberty, which reduces them to a state of blind obedience. Few people question the ritual, although there are occasions when the capping process fails and the person becomes a Vagrant, wandering aimlessly from place to place.

Will Parker meets one so-called Vagrant, who turns out to be a free man recruiting members for the resistance movement in the White Mountains. After a little persuasion, Will sets off with two friends to become a freedom fighter. The journey south is long and hazardous, with many memorable scenes such as the great Tripods lumbering across the landscape at night, the remnants of a long dead city full of the decaying marvels of a previous civilisation and the soaring peaks of the White Mountains at last within their reach.

The story continues in *The City of Gold and Lead,* with Will and another boy succeeding in penetrating one of the master's cities and returning with much valuable information. In the final volume, *The Pool of Fire,* they capture one of the aliens, a monstrous three-legged, three-eyed creature with green skin, who turns out to have one or two interesting weaknesses, even if he is not the most original of imaginary beings. By accident, the free men discover that alcohol, even in very small quantities, has a paralising effect on him.

So, armed with this vital knowledge, the free men secretly enter each of the alien's cities to pollute the water supplies. Two cities are destroyed, but the attack on the third fails and



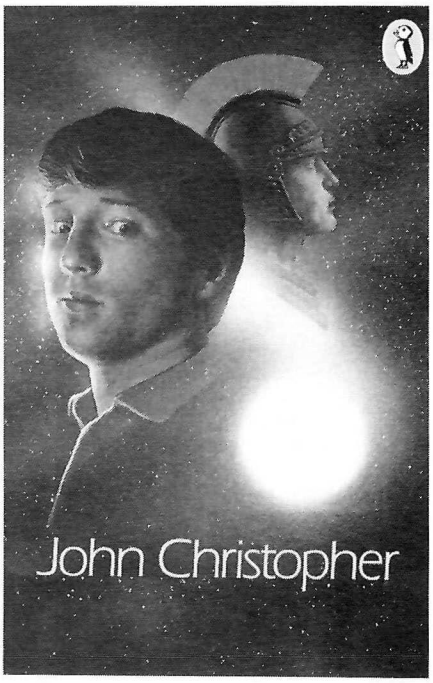


so a somewhat more ambitious plan is required. This time, the boys rise over the dome in balloons and drop bombs onto it, thus bringing the reign of the terrible Tripods to a dramatic end.

Although the free men ultimately win, there are no easy solutions. John Christopher remains a realistic writer, however fantastic the fictional world and at the end of *The Pool of Fire* it looks as though the old human conflicts, once eliminated by the capping, are about to return. Will does not look forward to the world to come; he nostalgically ponders the one they had lost, with its artificially-induced happiness: *'It was what most people wanted, but I did not. I thought of the world into which I had been born . . . the world of villages and small towns, of a peaceful ordered life, untroubled, unhurried, taking its pattern from the seasons. I thought, too, of . . . the days of riding and sitting idly in the sun, of summer meadows, trout-filled streams . . . No, the fine new world that was being built held few attractions for me.'*

More recently, John Christopher has been making ingenious excursions into slightly different territory. In *Fireball* (1981) and its sequel *New Found Land* (1983) he has created an alternative world which exists alongside our own, and the consequences are intriguing. Christopher refers to this world as the 'if' world and asks the question: what if the Roman empire had never fallen, but instead continued to rule Britain and Europe relatively unchanged. This is the situation which Brad and Simon find themselves in when a mysterious fireball transports them into the *if* world. They become involved in a revolt to overthrow the authorities in Rome, but opt out of the final onslaught and set sail across the Atlantic, where they encounter an alternative North America. *New Found Land* tells of their exploration of the New World and, like its predecessor, raises fascinating questions. One wonders whether there will be a third volume, making this another trilogy as entertaining and thought-provoking as *The Tripods* or *The Prince in Waiting?*

In the meantime we can look forward to the BBC adaptation of *The Tripods* which promises to be one of the major highlights for science fiction fans, young or old, in 1984.



Bibliography

This lists only John Christopher's children's books which are mentioned in the article. Several of his early adult movels have been reissued by Sphere in paperback and are also well worth sampling.

1967-8 *The White Mountains; The City of Gold and Lead; The Pool of Fire,* Hamish Hamilton, Puffin, 1981, 90p each.

1969 *The Lotus Caves,* Hamish Hamilton, Puffin

1970 *The Guardians,* Hamish Hamilton, Puffin

1970 *The Prince in Waiting; Beyond the Burning Lands; The Sword of the Spirits,* Hamish Hamilton, Puffin omnibus ed, 1983, £2.95

1974 *Wild Jack,* Hamish Hamilton, Puffin rep 1983, £1.00

1977 *Empty World,* Hamish Hamilton, Puffin

1981 *Fireball,* Gollancz, Puffin, 1983, £1.25

1983 *New Found Land,* Gollancz, £5.95 hardback only

An aerial view of the Ariane launch site at Kourou, French Guiana. Photo: CEF/B Paris

ARIANE

EUROPE'S LAUNCH ROCKET, ARIANE, COMPETES DIRECTLY WITH AMERICA'S SPACE SHUTTLE. IAN GRAHAM REVEALS HOW ARIANE CAME INTO BEING, THE MINI-INDUSTRY THAT SURROUNDS A LAUNCH AND THE FUTURE THAT THE EUROPEAN SPACE AGENCY (ESA) HAS PLANNED FOR IT

As long ago as 1970, European space watchers realised that the commercial exploitation of space would create a demand for Earth-orbiting satellites and the launch rockets that would place them in orbit. A series of surveys of potential satellite operators over the next three years confirmed their opinion. By the end of 1973, the programme to develop Europe's own launcher took off in earnest with a firm commitment to fund the project.

In fact, the roots of the current Ariane rocket programme go right back to British research work in the 1950s. Britain had developed a military missile called Blue Streak, but abandoned the project in 1960. Keen to capitalise on the expensive research, Blue Streak was kept alive as the proposed first stage of a new European launch rocket. As a result of a British initiative, the European Launcher Development Organisation (ELDO) was set up in 1964 to continue with Blue Streak as a civilian project. The participating countries were Belgium, France, West Germany, Italy, The Netherlands and the UK. Australia was also closely associated with the work, anxious that the Woomera Test Range should continue to be used.

The new launcher was called Europa 1. Blue Streak was the first stage, with a French 'Coralie' second stage and a German 'Astris' third stage. Italy provided the satellite test vehicles, Belgium the ground guidance station and The Netherlands data links. The project experienced a series of failures. The last launch which should have placed a satellite in orbit came to grief when the third stage lost thrust and the nose cone failed to jettison. Britain then withdrew from the project, recognising that it could launch satellites more cheaply by 'buying a ride' on an American rocket. Meanwhile, ELDO set itself the task of developing a more advanced version of Europa 1 – Europa 2. This would be topped by a French fourth stage.

Europa 2's first test launch in 1972 lasted little more than two mintues. The rocket veered off its planned trajectory and experienced such intense structural stresses that it exploded. While the next rocket was on its way to the launch site in French Guiana two years later, the project was dropped. The Symphonie telephone/television satellites which were to be launched by Europa were later launched atop American Delta rockets.

ESA's independent launcher

The newly formed European Space Agency (ESA) recognised a two-fold requirement for a European launcher. Firstly, they predicted a sharp up-turn in the numbers of commercial satellites to be launched in the late 1970s and 1980s and it made good business sense to try to sell a launch service to the satellite operators. Secondly, it was thought likely that America would be reluctant to launch European satellites, particularly communications satellites, that would compete directly with American satellites for business.

France had consistently argued that Europe should have an independent launch capability and tried to win support for an improved Europa 3. When their proposal received a cool response, they came up with a cheaper and less sophisticated design. This more acceptable design eventually became the L3S project, better known as Ariane.

Ariane's design owes a good deal to Europa 3. Versions of the Viking engines intended for use in Europa 3 are used in Ariane's first and second stages. The first stage uses four Viking V engines and the second stage a single Viking IV engine. The third stage is powered by Europe's first cryogenic (very low temperature) power unit. The propellants are liquid hydrogen and liquid oxygen, held in tanks pressured by gaseous hydrogen and gaseous helium respectively.

After launch, the stages are separated by explosive charges and then moved apart by rockets – retrorockets in the lower stage and acceleration rockets in the upper stage. The three stages are separated automatically on command from an on-board computer. Ariane is launched from a site half way round the world – at Kourou in Guiana, on the North coast of South America. This site was chosen by France from a short-list of 14. The prime criteria for its selection were that the first stage could fall back to earth without any danger (into the Atlantic Ocean) and that it should be as close to the equator as possible to take advantage of the extra velocity acquired 'free' by virtue of the Earth's rotation.

Guiana space centre

The Centre Spatiale Guyanais (CSG), the Guiana Space Centre, became operational in 1968. From there, a sounding rocket called Veronique and seven Diamant programme satellites were successfully launched up to the mid-1970s. There was then something of a lull in operations until the centre was re-activated by ESA to participate in the Ariane programme. The centre is still owned by the French government which makes it available to ESA's member states under the terms of an agreement. In return for the use of facilities, ESA must contribute a percentage of the centre's funding. Later this year, the agreement is due to be reviewed and extended to cover 1984-1989.

Guiana isn't the most hospitable area to city-dwelling scientists and rocket engineers – most of it is covered by Amazonian forest. The climate is equatorial, with the temperature never falling below 20°C and sometimes reaching 32°C (phew!). The weather pattern is not as varied as ours – it's either wet or it's not, depending on the time of year. Of the country's 73,000 inhabitants over half live in the capital, Cayenne. Kourou itself accounts for another 7,000, 700 of whom work at the space centre and live nearby with their families.

The centre's activities extend from Kourou to the next town along the coast, Sinnamary, and 15 km out into the Atlantic Ocean. The technical centre in the middle of this area houses management and launch control. The launch sites themselves are 10 km north-west of that. At 10 km and 50 km south-east of the technical centre, there are measurement facilities whose job is to collect data from vehicles launched from the centre. Once a rocket has left the immediate area of the centre, it is tracked and its data collected first by a station at Natal in Brazil and then by a NASA/Dept of Defence station on Ascension Island. The Ascension station is in contact with the payload until its injection into Earth orbit.

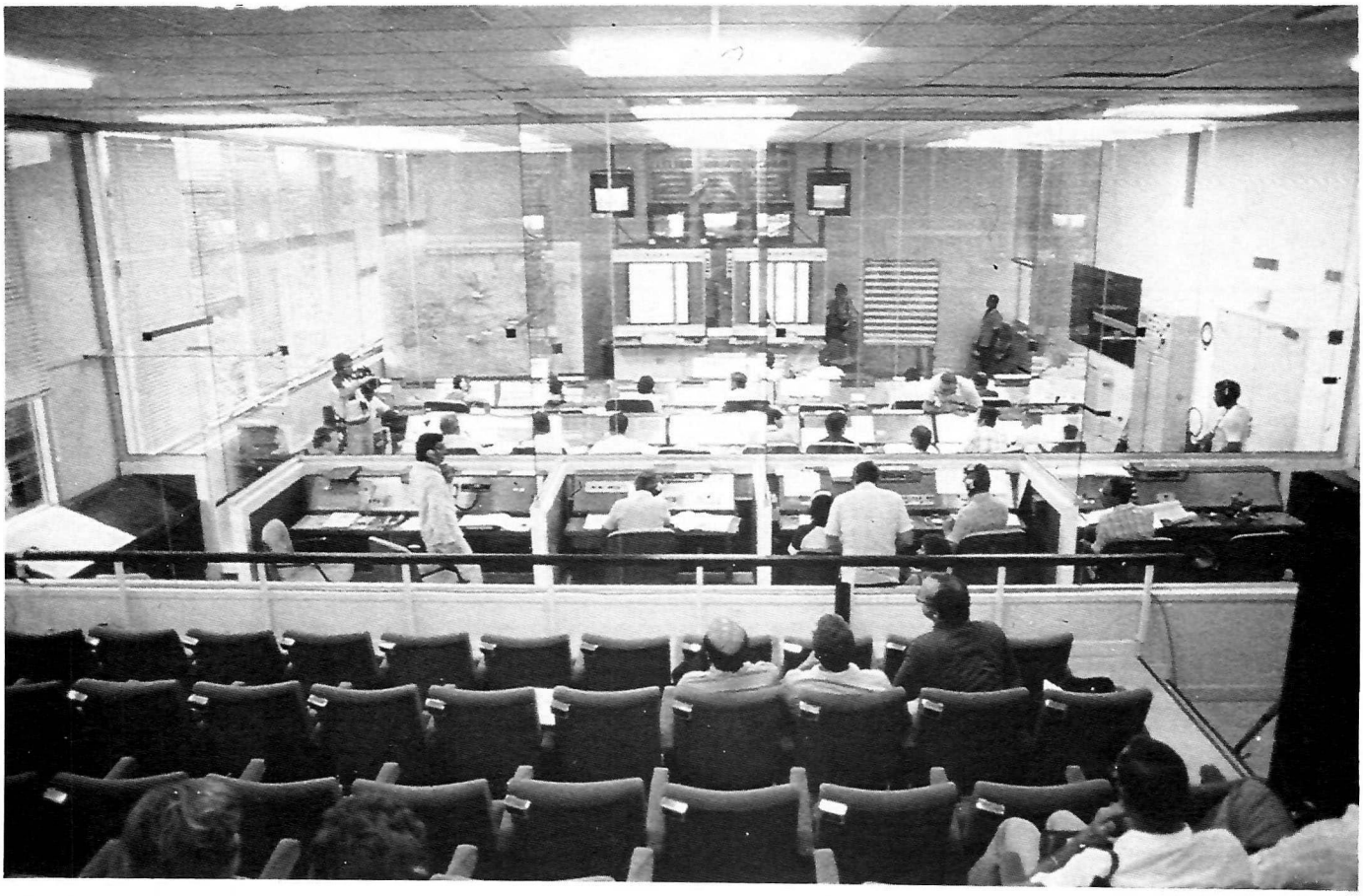
New launch pad

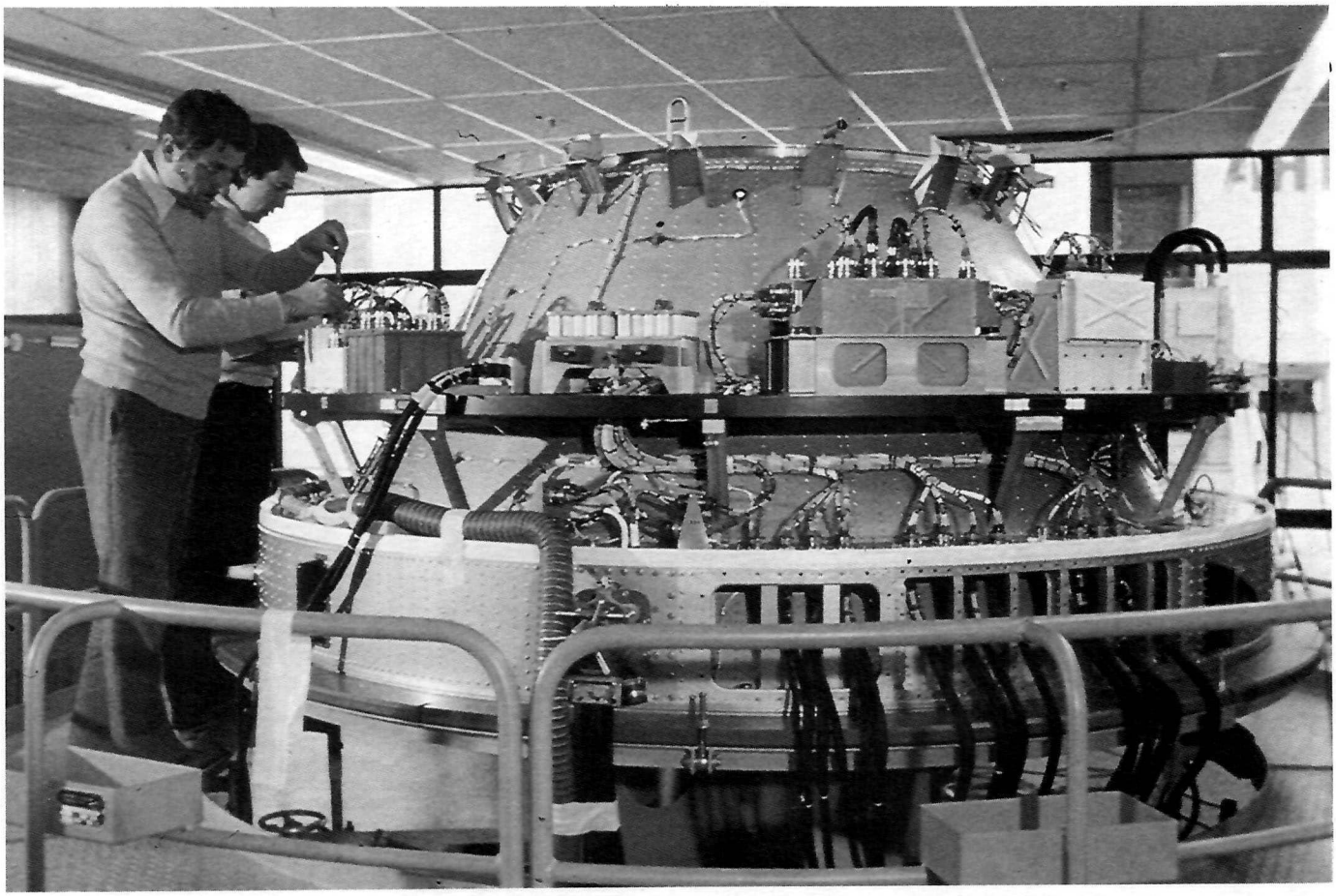
All launches to date have used the same launch site, ELA-1. Now a second (ELA-2) is under construction. ELA-1 is designed for up to six launches per year. Like all the other facilities and equipment produced under the Ariane programme, these launch sites and the payload preparation facility belong to ESA. ELA-1 isn't simply a launch pad. It also includes an assembly area, where the rocket parts are mated together, a liquid hydrogen and oxygen plant to provide propellant and the launch pad itself. There are also support services and laboratories.

The final launch preparations and check-out procedures are supervised from a blockhouse only 200 metres from the rocket. As you can imagine, this building is heavily defended against the worst disaster that might befall the rocket. It can withstand a nearby explosion, the impact of parts of the rocket (especially the engines) if it should be destroyed in flight and toxic gases escaping from tanks.

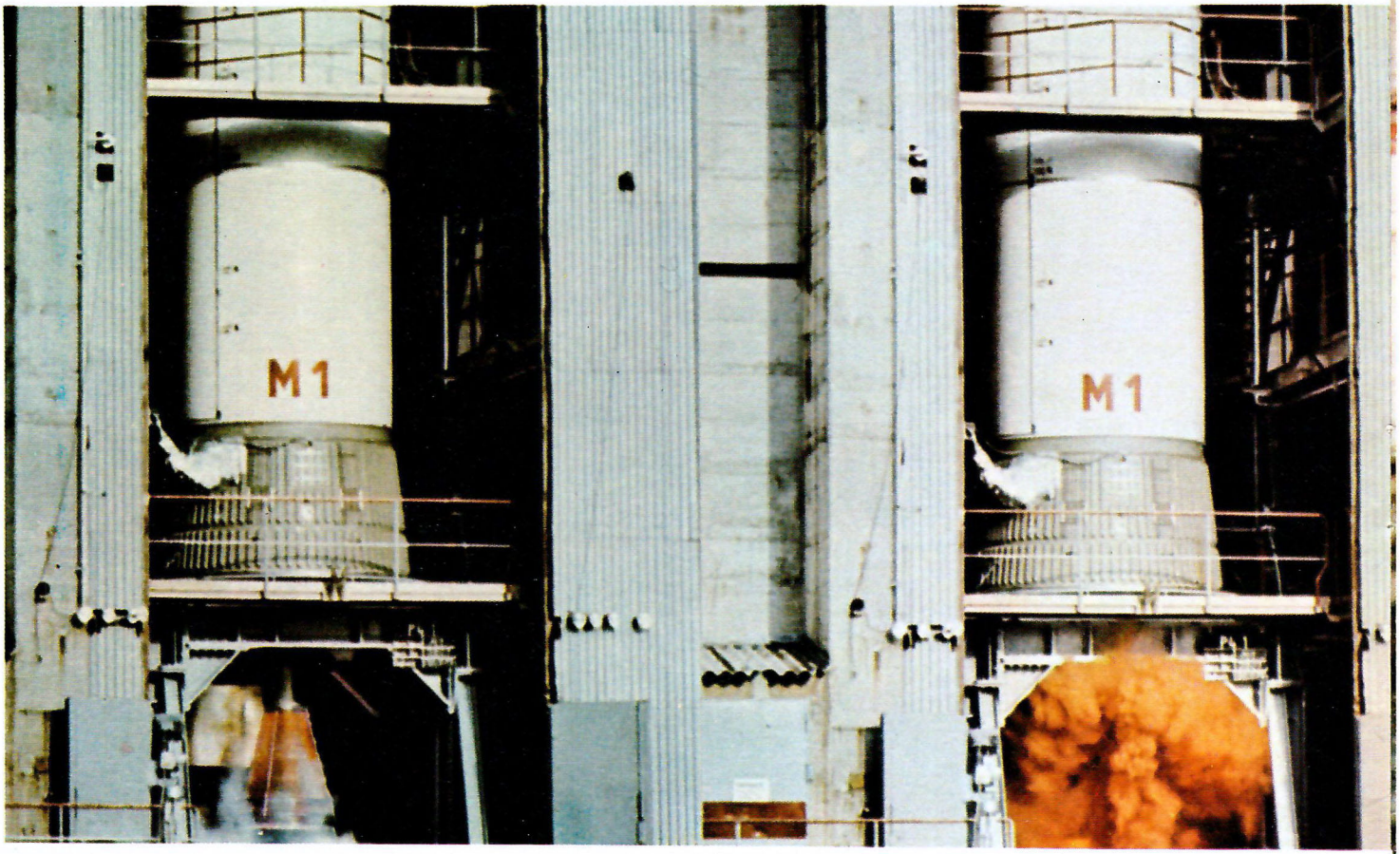
The second launch site (ELA-2) now nearing completion is organised rather differently. The launch preparation zone is completely separated from the launch pad itself. At ELA-1 only one launcher can be handled at a time, but the more flexible arrangements at ELA-2 allow one launcher to be prepared while a second is still sitting on the pad, halving the minimum time interval between launches. The three zones –

Launch Operations Control Centre at the Guiana Space Centre, Kourou. Photo: CEF/B Paris





Below: Assembling the nozzle onto the third stage engine combustion chamber at Messerschmitt-Bolkow-Blohm in West Germany. Above: Coupling the equipment bay to the rocket structure at Matra in France. Photos: CEF/B Paris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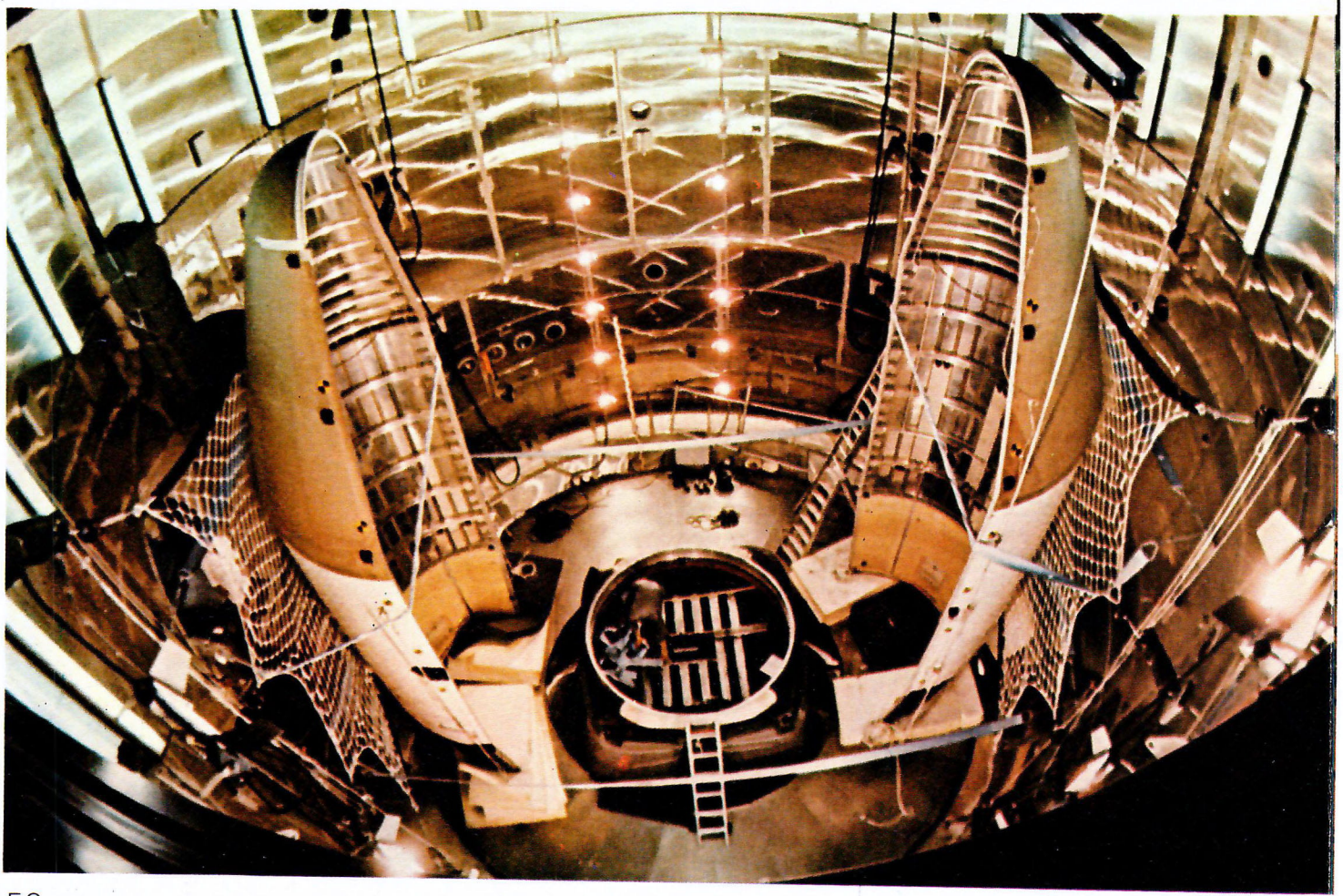
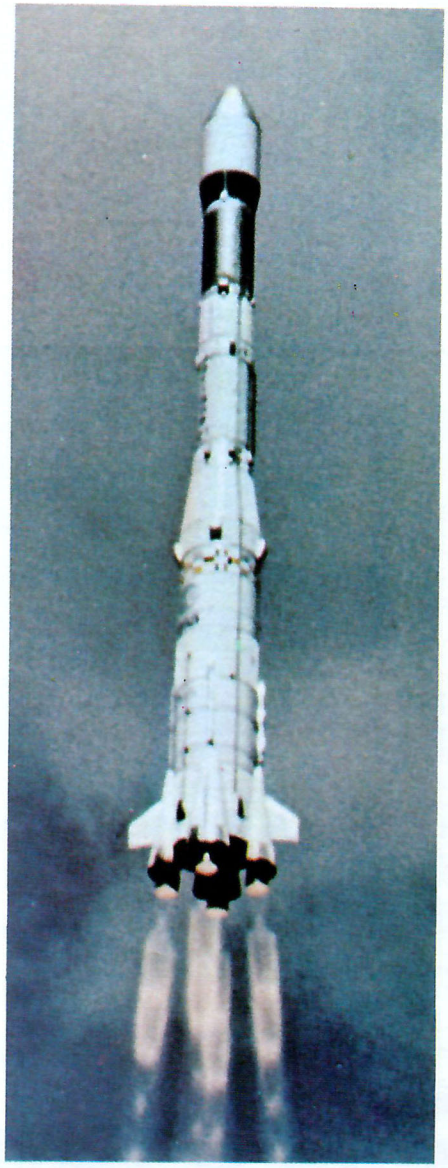
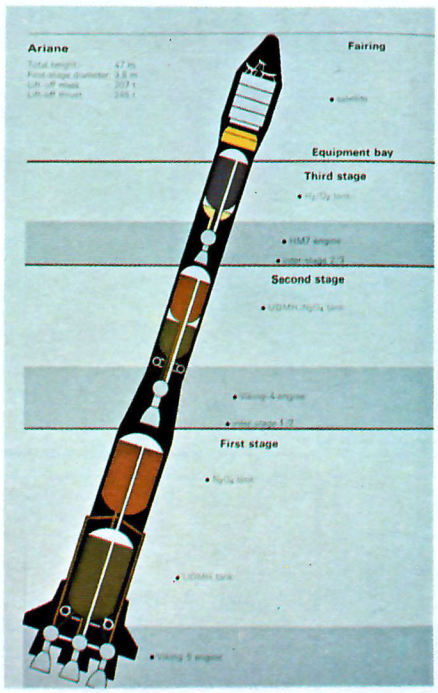






launcher preparation, ELA-1 and ELA-2 are each a safe distance from the other two. The launcher preparation area is connected to the launch area by a railway track along which the launcher can be transported in an upright position on a mobile platform.

Ariane's track record

Ariane has had mixed fortunes. The first test flight (LO1) in December 1979 was a total success. The second test flight (LO2) in May 1980 ended in the destruction of the launcher after 108 seconds.

In fact, trouble had set in only 5.75 seconds after first stage ignition. A high frequency (in excess of 2000 Hertz) vibration in one of the four Viking V engines was so violent that it altered the behaviour of the engine's fuel injector. The injector distintegrated and the engine destroyed itself 64 seconds after ignition. The fire that broke out in the propulsion bay spread into the fuel tanks and the rocket exploded.

The cause of the instability in the engine was eventually attributed to a slight variation in the manufacture of the injector. The fault, which could have appeared at any time, did not show up in over 200 test firings of this type of engine. Consequently, manufacturing tolerances were adjusted.

The third flight (LO3) in June 1981, using an Ariane fitted with modified injectors, carried Meteosat 2, a European meteorological satellite, and an Indian communications satellite called APPLE (Ariane Passenger PayLoad Experiment) and was a complete success. The launcher behaved perfectly.

The fourth and final test flight (LO4) in December 1981 was also a complete success. It placed a MARECS-A maritime communications satellite in orbit. This flight was treated less as an experiment and more like an operational flight. Thus the development phase was brought to a close and Ariane was declared operational. The first of a series of seven planned promotional flights took place under the auspices of ESA, with subsequent responsibility for marketing, manufacturing and launching Ariane to be handed over to a private company called Arianespace.

Launcher under pressure

The first promotional flight (L5) carried a dual payload – MARECS-B and SIRIO-2, both European satellites. The launch initially went well. The first and second stages behaved correctly. The second stage separated from the third, whose engine started. Then 561 seconds after ignition, something happened to the third stage engine – the turbine speed dropped, followed by a reduction in the combustion chamber pressure.

The launcher and its payload failed to reach orbit, because a pump in the third stage failed and cut off the supply of fuel to the single engine. It is thought to have failed because of insufficient lubrication of its gearing and an 'unfavourable combination of the various tolerances, which, taken individually, were all within the specified manufacturing limits' . . . manufacturing tolerances again. Turbopumps already manufactured for later flights were taken apart and modified according to the findings and recommendations of ESA's Board of Inquiry.

Flight 6 (L6) in June 1983 successfully placed the European Communications Satellite (ECS-1) and AMSAT P 3B (radio AMateur SATellite Phase 3B) in orbit. For the first time, a system called SYLDA (Systeme de Lancement Double Ariane) was used. It consists of a support structure and three separation systems – one for each of two satellites and one for SYLDA itself. It allows Ariane to accommodate and release two independent Delta class satellites.

Ariane L7, launched in October 1983, successfully placed an Intelsat V F7 communications satellite in orbit. The most recent launch (V8) on March 5th 1984, successfully placed an Intelsat V FU8 communications satellite in orbit. From now on, Arianes will be identified by a V (French 'vol' meaning flight) number instead of an L (launcher) number.

Ariane's future

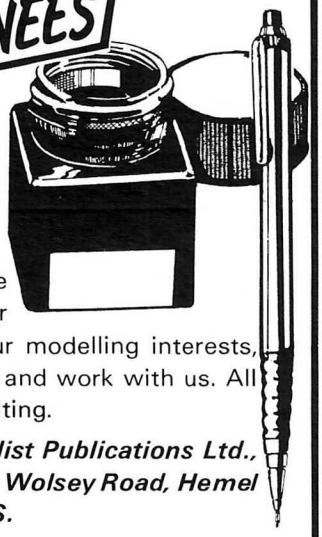
Where does Ariane go from here? In its present form, Ariane 1 can place up to 1.7 tonnes of payload in Earth orbit. By increasing the operating pressure of the engine combustion chambers and enlarging the fuel tanks, Ariane 2 will be able to place up to 2.175 tonnes in orbit. Then simply adding strap-on booster rockets to the first stage allows Ariane 3 to place up to 2.58 tonnes in orbit. Beyond 1985, satellite operators will want to launch even bigger payloads, and so there are plans to produce an even more powerful version, Ariane 4. Six variants of this will be available, capable of carrying payloads of from 2 to more than 4 tonnes. These developments are being pursued to try to cut the cost per kilogram of payload to orbit. Ariane 4 should slash the current cost by 40%. Beyond Ariane 4, ESA is considering proposals for a new engine which might allow its launcher to place 15 tonnes in orbit by the 1990s. Another possibility is a totally recoverable rocket.

So, despite a couple of spectacular setbacks, Ariane seems to be doing well and Arianespace has a healthy launch reservation book. Of course its main rival is the American Space Shuttle. However, of the two satellites recently lost because defective booster engines, one *was* to be launched by Ariane, but the operator was persuaded to switch to the Shuttle. Fortunately, there aren't sufficient rockets, Shuttle launches and Arianes to go round the satellite operators, so the two agencies can continue in earnest but amiable rivalry for the foreseeable future.

Above: Ariane's first test launch on December 24th 1979. Photo: CNES/CSG/Optique
Left: The Ariane launcher's constituent parts. Photo: CEF/B Paris
Above Left: Ground test of the second stage on the P4 stand at the DFVLR (West Germany). Photo: CEF/B Paris
Far Left: Ejection test of the fairing in the large vacuum chamber at ESTEC in The Netherlands. Photo: ESA/ESTEC

EDITORIAL

TRAINEES



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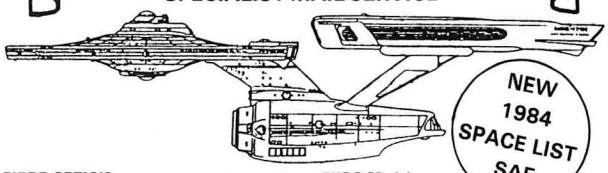

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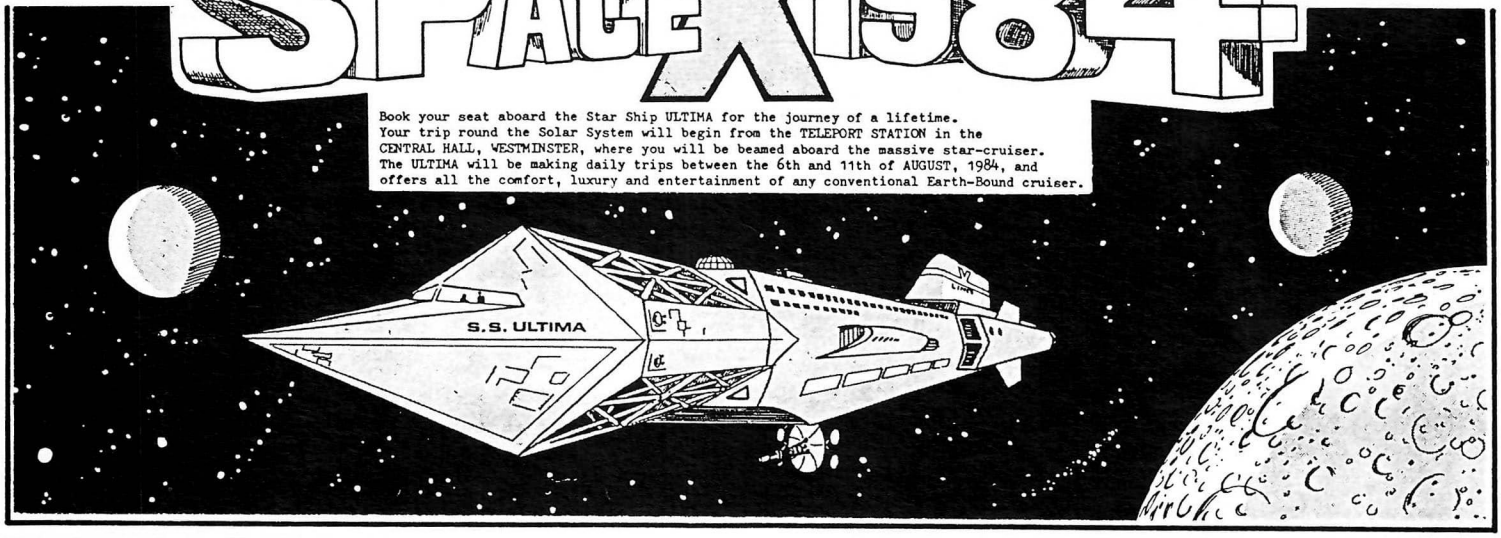

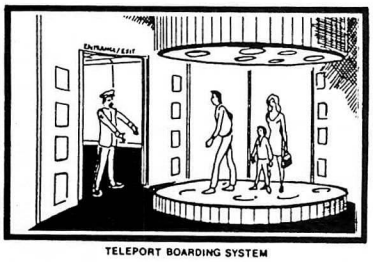

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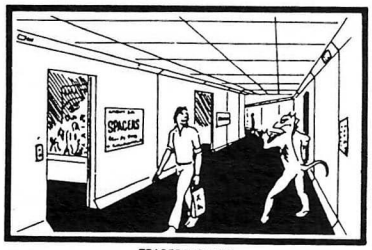

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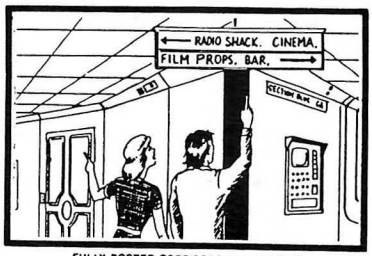

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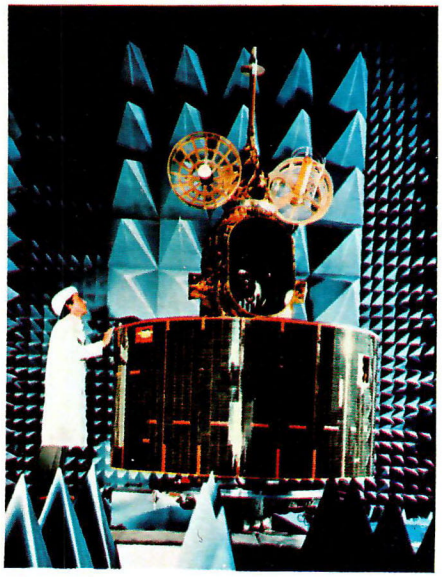
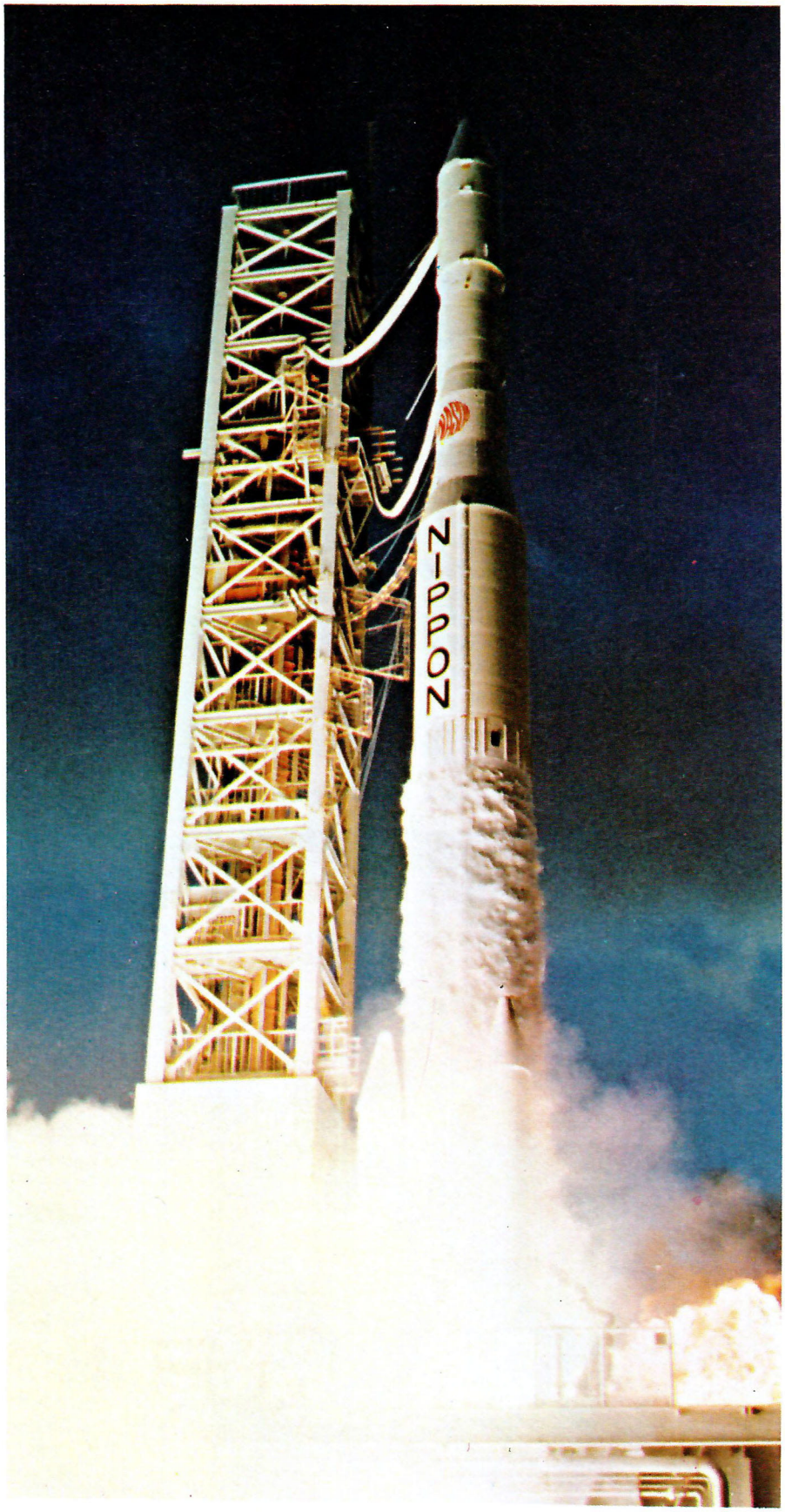
JAPAN IN SPACE

THE LAND OF THE RISING SUN IS STEPPING UP ITS INVESTMENT IN SPACE TECHNOLOGY. DR J K DAVIES OF LEICESTER UNIVERSITY'S REVEALS THE EXTENT AND DIVERSITY OF THE JAPANESE SPACE PROGRAMME





Above: The launch of the second engineering test satellite KIKU-2 by an N-1 launcher. The N-1 was based on imported American technology and built under licence in Japan. Left: The second of Japan's Geostationary Meteorological Satellites GMS-2. The first GMS joined European and American spacecraft in the World Weather Watch experiment. Photos: NASDA

The 1970s may go down as the decade of the planetary spaceflight, but for NASA it was also a decade of cutbacks, delays and cancellations. One space agency, however, enjoyed a period of rapid growth with a budget rising sevenfold and still rising in the 1980s. This new star rose in the East, from Japan. Japan has orbited 26 satellites, mostly using Japanese assembled launch vehicles and expects to continue to average two launches a year throughout the decade.

Post war Japan recognised the need to remain at the forefront of technological development and organised its space effort to fulfil a clearly defined space policy. Guided by a Space Activities Commission, which reports directly to the Prime Minister, this policy stresses peaceful space exploration aimed at meeting national needs and anticipates the day when space will play a major role in Japanese daily life. In the next few years developments will include communications and earth observations satellites, microgravity research and a new national launch vehicle. International co-operation will include manned space operations in conjunction with the US Space Shuttle.

These programmes will be divided, as they have been since 1969, between the scientific activities of the Institute of Space and Astronautical Sciences, and the development of applications satellites and launch vehicles by NASDA, the National Space Development Agency.

Application satellites

The geography of Japan has often restricted domestic communications so not surprisingly the development of satellite communications has high priority. The programme started well with the 1977 launch, by NASA, of the experimental communications satellite, SAKURA. This should have been followed by a second satellite, AYUME, launched by a domestic rocket. Unfortunately this satellite was lost after striking the upper stage of the launcher after separation. The backup satellite, AYUME-2, was lost a year later during the apogee motor firing intended to place it into geostationary orbit. These two failures led to the resignation of the then NASDA chairman Akiyoshi Matsuura.

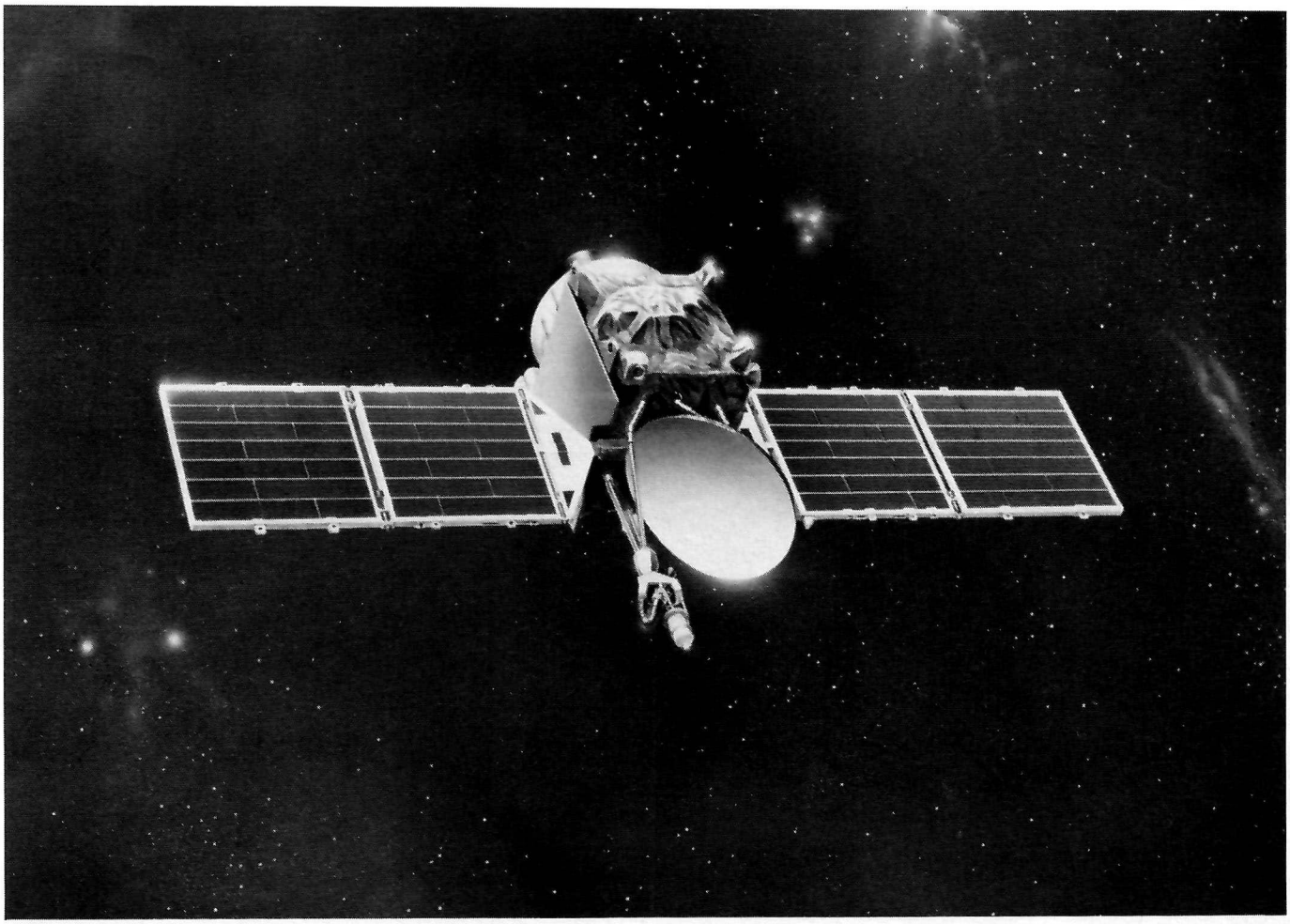
Nevertheless NASDA continued to work towards an operational system and last year successfully launched two CS-2 (SAKURA-2) satellites. The CS-2 satellites are spin stabilised and use advanced technology to produce an antenna coverage pattern shaped to ensure good K-Band coverage of the Japanese mainland, with additional frequency coverage of the outlying islands. The CS-2 system is designed to allow telephone, TV and datalink communication throughout Japan and can be used by small transportable ground stations, an obvious advantage for natural disaster and emergency relief.

NASDA's role in the development of communications satellites will continue into the 1980s with the launch of the world's first operational direct broadcast satellite, codenamed BS-2a and BS-2b. The BS-2 programme will demonstrate Japan's competitiveness in the manufacture of direct broadcast satellites and improve television reception in mountainous regions of Japan and in its outlying islands. The system should provide two channels of colour television to homes equipped with inexpensive receivers.

Scientific satellites

The 13 launches of the scientific agency ISAS have included test vehicles and satellites for the study of the ionosphere, the sun and distant X-ray sources. The most recent of these, an X-ray astronomy satellite called ASTRO-B, was launched on February 20th 1983. This will be followed this year by EXOS-C which will make observations of the stratosphere and mesosphere as part of the International Middle Atmosphere Programme.

BS-2, Japan's first direct broadcasting satellite, was launched in January 1984. Ahead of its European rivals, it demonstrates that Japan is moving ahead in developing commercial space activities. Photo: NASDA



Probably the most exciting of Japan's planned space activities of the eighties is the dual MS-T5/Planet-A mission to explore the interplanetary medium and to intercept Halleys Comet. The pathfinding MS-T5, essentially a prototype Planet-A, will be Japan's first deep space probe and will be launched on the last day of 1984. It will observe the solar wind downstream of Halleys Comet and may even attempt to fly through the comet's ion tail. Planet-A, to be launched in August 1985, will fly past the comet about one month after its closest approach to the sun. During the fly past Planet-A should make ultra-violet images of the comet and its surrounding hydrogen clouds.

Although Japan has no indigenous manned spacecraft the SAC have indicated a role for Japanese astronauts in the Space Shuttle programme. This interest is evidenced by a joint Japan-US experiment carried on the first spacelab mission. SEPAC (Space Experiments with Particle Accelerators) probed the space plasma by injecting streams of charged particles from electron and ion beam accelerators. Japan takes part in various international cooperative projects with America, the European Space Agency and Canada, as well as being members of the International Communication Satellite Agencies INTELSAT and INMARISAT. Japan is investing heavily in space, and despite some setbacks their commercial satellite programmes are maturing quickly. This is the result of a consistently funded, carefully thought out space development policy. It is a lesson the West would do well to heed.

Japan's space policy also emphasises the use of satellites as an aid to the exploitation of land and marine resources. As a first step towards this goal Japan established an Earth Observation Centre at Hatayama in 1978 for the reception, processing and distribution of images from American Landsat satellites. The EOC is able to receive, and decode, Landsat data and then produce 70 mm colour film of the final images. A quick look facility allows rapidly varying natural processes such as volcanic eruptions, icebergs and storms to be monitored.

The second stage of this programme will be the launch, in 1985, of the Maritime Observation Satellite MOS-1. MOS-1 is an experimental programme to establish in Japan the expertise for earth resources satellites. MOS-1 will be equipped with visible, infrared and microwave radiometers for monitoring the sea surface and the atmosphere. Other Earth observation tasks are undertaken by two Geostationary Meteorological Satellites, launched in 1977 and 1981, which monitor the weather of large areas of the eastern Hemisphere.

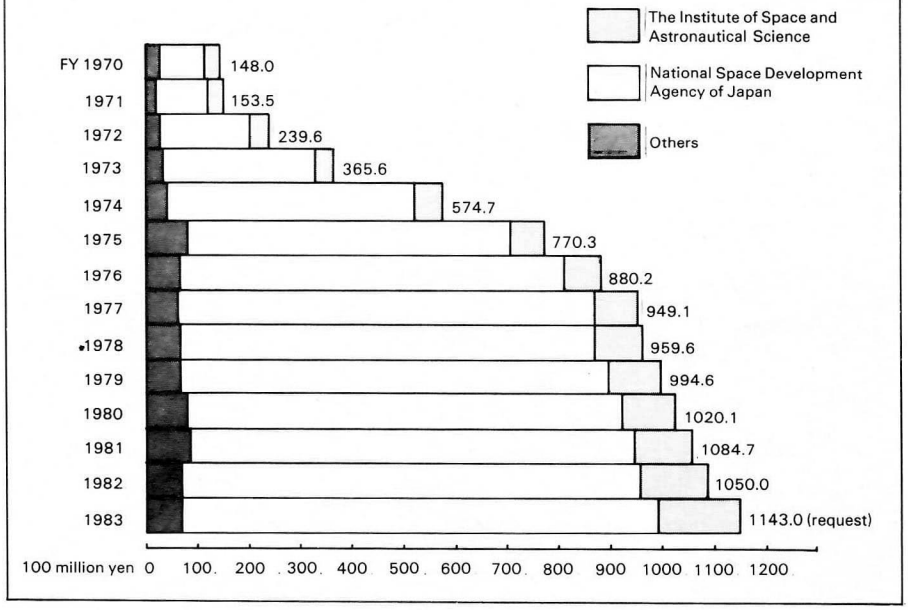
Launch vehicles

Like Europe, Japan realised that the commercial exploration of space would require an independent launcher capability but, unlike Europe, Japan has based her launcher programmer on imported American technology. NASDA's main space launcher is the N-II rocket, a developed version of the N-1 vehicle, itself a derivative of the American Thor Delta series. Like the Delta, the N series rockets use strap-on solid fuel rockets to provide extra thrust at lift off. The boosters and the first stage engine are built in Japan under licence. The N-

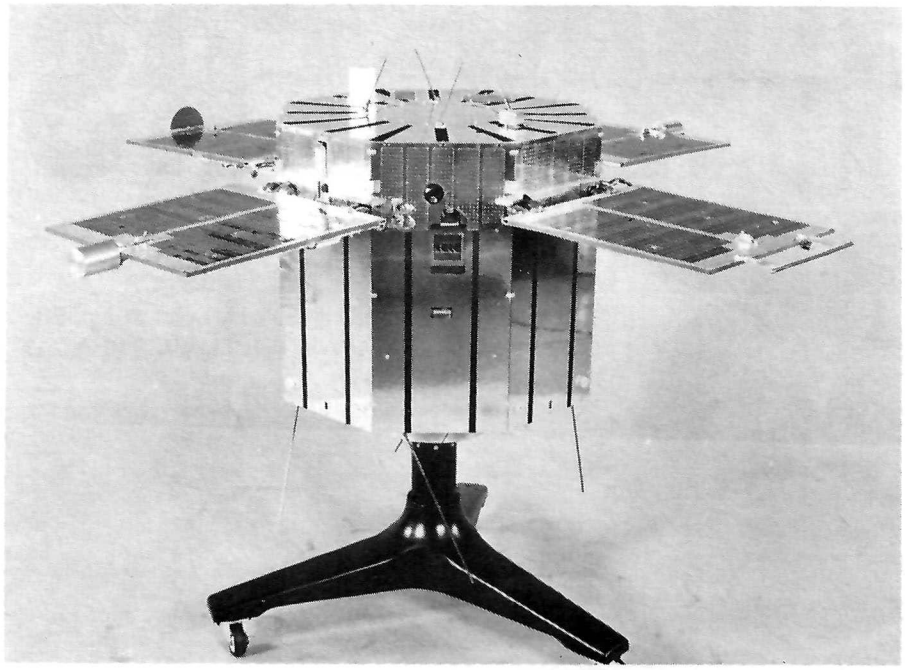
Recent and Future Japanese Space Activity

1982:	Engineering Test Satellite III	Technology Development
1983:	ASTRO-B	X-Ray Astronomy
	CS-2a	Operational Domestic Communications
	CS-2b	Operational Domestic Communications
1984:	EXOS-C	Upper Atmosphere Research
	BS-2a	Direct Broadcasting
	GMS-3	Weather Satellite
1985:	PLANET-A	Interplanetary Monitoring and Halleys Comet Intercept
	BS-2b	Direct Broadcasting
	MS-T5	Engineering Test
1986:	MOS-1	Maritime Observation Landsat
	H-I + ETS IV	New Heavy Launch Vehicle plus Engineering Test Satellite
1987:	ASTRO-C	X-Ray Astronomy
	ETS V	Technology Development
1988:	CS-3a	Domestic Communications
	CS-3b	(Proposal)
1989:	EXOS-D	Scientific Satellite (Proposal)

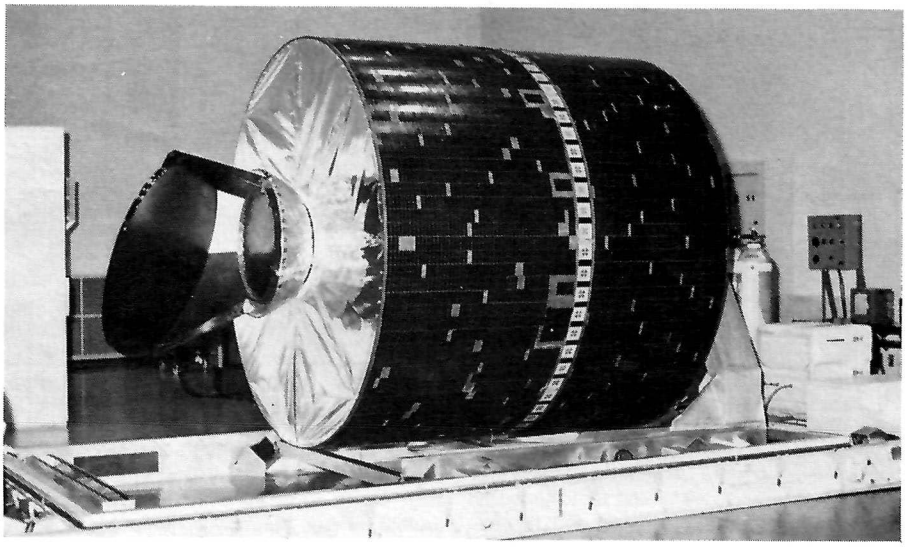
Budget for Space Activities

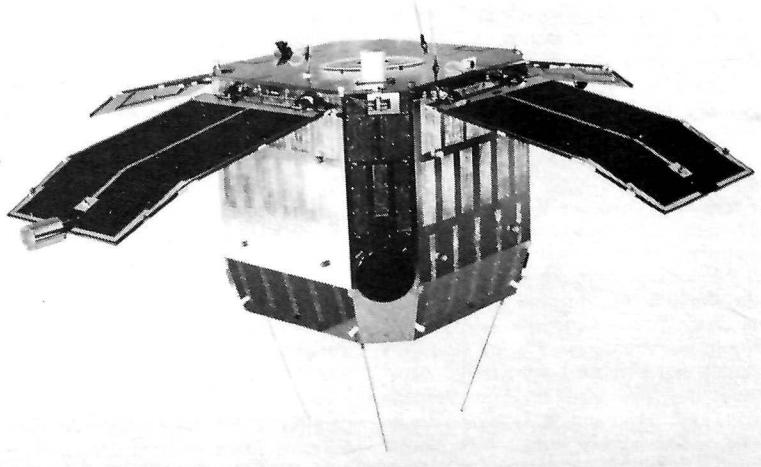


Engineering Test Satellite-3 was used to develop technology for spacecraft requiring high electrical power supplies from solar panels. Photo: NASDA.



Above: Developed by the University research group ISAS, the Astro A satellite was launched in 1981 to study the Sun using X-rays which are blocked out by the Earths atmosphere. Photo: ISAS. Below: One of two CS-2 'Sakura' communication satellites launched in 1983 which are providing services to both mainland Japan and its outlying islands. Photo: NASDA. Bottom: The Astro-B satellite is used for X-ray astronomy, making observations of active stars and galaxies. It was developd by the inter university group ISAS. Photo: ISAS.





II can place about 350 kilograms into geostationary orbit and will be the mainstay of NASDA's application satellite programme until the arrival of a new generation launcher in the late 1980s.

The first stage of this new launcher, the H-I, is similar to the N-II vehicle but overall performance is improved by the introduction of a powerful new second stage using liquid oxygen and liquid hydrogen propellants. The third stage of the H-I will be a 9 tonne thrust solid rocket motor. This launcher is expected to launch up to 550 kg into geostationary orbit, and a follow-on vehicle which may almost double this performance is under study. Launch of a two stage version of the H-I is expected in 1986, orbiting an experimental geodetic satellite. This satellite, a two metre diameter sphere covered with cube-corner laser reflectors and mirrors will be used in conjunction with lasers and precision photography to establish a new geodetic network for Japan. The first 3 stage H-I will be launched in 1987, although contingency plans exist for a second two stage test if necessary, and operational flights will begin in the following year.

Japanese scientists have proposed various new missions, several involving international co-operation. Although not all have been approved at present the variety of proposals is indicative of the progressive nature of Japanese space science.

IRTS	An infra-red telescope to be flown on a space shuttle mission about 1985.
TSS	A tethered spacecraft to be released from a space shuttle mission around 1988.
EXOS	Two further satellites to probe the near earth environment in 1987 and after 1990.
OPEN	Collaborative studies with the NASA project on the Origin of Plasma in the Earth's Neighbourhood. This may be supplemented by an all Japanese satellite, OPEN-J.
AXAF	Co-operation with NASA in the Advanced X-Ray Astronomy Facility towards the end of the decade. This might include a Japanese satellite codenamed CXGT.
UVSAT	An ultraviolet astronomy satellite.
HESP	A High Energy Solar Physics mission for the next decade.
Planet B & C	Satellites for observations of Venus following on from the Planet-A mission.
Saturn Orbiter	Studies are under way of a two spacecraft mission to Saturn, with one craft built by NASDA, the other by the ISAS.

The author would like to thank the Japanese Space Agency (NASDA) and the Institute for Space and Astronautical Science (ISAS) for supplying the information and photographs used in this article.

THE S-F WRITER'S MARS

MARS HAS FASCINATED WRITERS FOR CENTURIES. RICHARD AND MARION VAN DER VOORT REVEAL HOW WRITERS HAVE TREATED THE PLANET IN PRINT

One of Shakespeare's most repeated quotations is from Mark Anthony's speech over Caesar's corpse, 'Cry Havoc, and let slip the dogs of war.' The dogs, called Fear and Terror were infamous lieutenants of the god of war. When it was discovered that the planet Mars, named for the Roman war god, had two small satellites, they were promptly christened by the Greek form of their names, Phobos and Deimos, which demonstrates how irrational our literary and scientific history is.

Today we picture the ancient Greeks as a nation. In fact, they were a collection of city-states, often at odds with each other, in particular the martial Spartans and the philosophical Athenians. In the end the Athenian culture took the lead, and we have a private fancy that Ares, the Greek god of war, basically depicts the Spartan through Athenian eyes, as tough, brave, unintelligent and boring.

The Babylonians were probably the first to discover the planets, but the Greek name, planets, which means wanderers, survives into our time to commemorate the first discovery that certain lights moved against the background of the *fixed* stars. But the Romans eventually took command of the known world. Latin survived after them and by the time that telescopes revealed that these lights were globes, Latin was regarded as the tongue of science, and the planets were given Roman names. Mars, the Roman equivalent of Ares, wasn't all that popular as a god – even the legionaries preferred Mithras, but the reddish colour of our neighbour made Mars seem appropriate.

The first SF writers saw Mars as an evil planet, inhabited by creatures all too ready to invade our world. H G Wells is probably the only writer of this era still in print. His short story, *The Crystal Egg* tells of a crystal that acted as an interspacial TV receiver, which tunes into both planets simultaneously, and is lost, but it is his novel *The War of the Worlds* that still holds people's imagination.

It is set in our area. Martian fighting machines stalked along the Thames at the bottom of our road, and our shop may have been built on the site of the house partially demolished by one of the Martian cylinders, so we do have a sentimental feeling for this book.

Target Earth

Wells postulates that Mars is inhabited by a race of mechanical geniuses who cast a giant cannon to fire their projectiles towards the earth. The flare of the casting and the firing of

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R	A	U	B	U	H	A	K	W	G
P	B	S	D	S	R	N	E	J	Q
R	E	G	A	E	Y	Y	T	F	B
H	V	L	C	T	Y	Y	E	U	F
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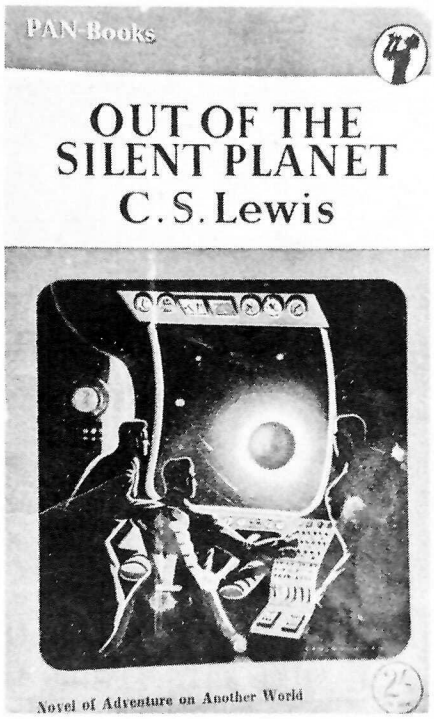


the cannon are both seen by mankind, but the fall of the first cylinder causes great surprise, which turns to terror as the Martian weapons are revealed.

The narrator observes them closely and describes them as possessing huge heads, about four feet in diameter, resting on bunches of tentacles, with one eardrum at the back of the head, no nostrils, two large dark eyes and a kind of fleshy beak. They possess an extra large brain, heart and lungs but no digestive system. Instead they withdraw blood from living creatures and inject it directly into their veins.

Last and First Men, written by Olaf Stapledon in the early thirties, and originally published by Penguin as non-fiction, depicts the history of mankind over several million years, through 18 different races, and includes yet another Martian invasion.

Stapledon's Martians were individual bacteria-sized units which coalessced into a less intelligent group mind. Having killed off most life on their own planet they turn their attention to earth. Their purpose was to take back food and water to their dying planet, and to rescue the precious crystals that they worshipped, in particular diamonds, from Earth. These Martians were also coldly logical, and the war lasted for centuries. The Martians were repelled again and again, but even their dead proved fatal to humans. Their submicroscopic particles lodged in human lungs and produced a race of invalids. In the end, by unanimous resolve, a virus is released that will not only destroy the Martians, but will also kill off mankind. In the event, only the Martians are destroyed.

In Philip Jose Farmer's *Jesus on Mars,* an Earth expedition to Mars discovers in a hidden cave a human/alien civilisation who are Orthodox Jews. They also believe in Jesus, living permanently with them, as the Messiah, and set out to spread this belief to Earth.

Bug-eyed poets?

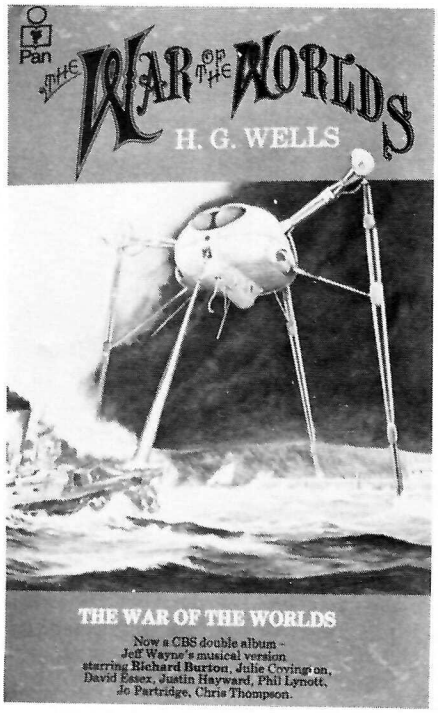
Eric Frank Russell, in *Dear Devil,* has the Martians visiting a devastated Earth, inhabited only by a few stunted children. Fander the poet decides to stay there, armed only with his harp. Despite his blue, glowing, rubbery skin, his many tentacles, his enormous bee-eyes, and his lack of voice, Fander makes friends on Earth. Russell also uses Martians in *Men, Martians and Machines,* who resemble Wells's Martians physically, but they are depicted as chess fiends, outside repair workers, needing only a headpiece and less than three pounds pressure of atmosphere, and generally accepted as part of the crew rather than aliens.

Burroughs on Mars

In 1912 Edgar Rice Burroughs leapt into the fray with his hero, Colonel John Carter of Virginia, who found himself magically transported to Mars, called Barsoom by its inhabitants, to encounter humanoids, six limbed Martians, great white apes, plant men, etc, ad nauseum. Tars Tarkas, Jeddak of Thark and Carter's best friend is perhaps the most famous. He stood 18 feet high, a glossy green, bipedal with two pairs of arms. Facially he had two gleaming white tusks protruding from his massive lower jaw to a point near the centre of his forehead, with laterally placed protruding eyes that could see all round him without moving his head.

John Carter, coming from a heavier gravity planet, was stronger and faster than the average Martian, but a perfect match in temperament. He had a dreadful habit of shouting 'Way for the Prince of Helium' and decapitating any unfortunate between him and his goal, but then most of the inhabitants of Barsoom seemed to be cannon fodder anyway, and John Carter made himself so perfectly at home he became Jeddak of Jeddaks, Warlord of Barsoom.

An entirely different Mars appeared in 1938, written by C S Lewis, a theologian. Neither science fiction or fantasy, *Perelandra* or *Out of the Silent Planet* tells of Ransome, a philologist who is kidnapped and taken to a strange world that he discovers gradually to be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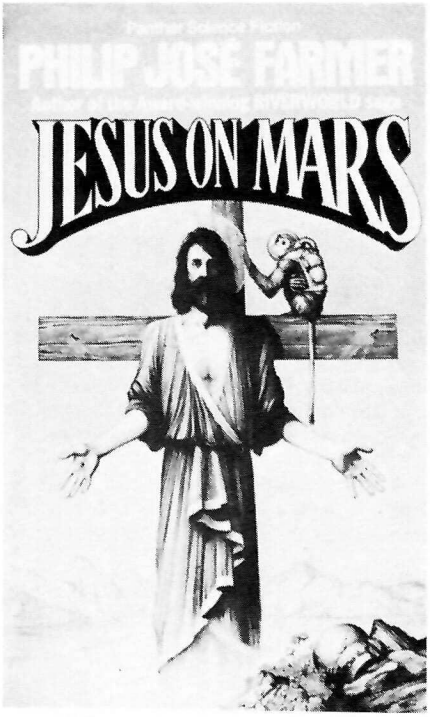
Mars. Maybe theologians should write more about other worlds, the sense of wonder that seems to be disappearing from science fiction is in ample evidence as we look through the eyes of a non-scientist.

'His first impression was of a bright, pale world – a water-colour world out of a child's paint-box'. Malacandra, as Ransome learns to call it, has blue warm, effervescent water, limp-trunked trees with huge, thin purple leaves, pinkish-white grass and huge rose-coloured



mountains. He gradually meets the inhabitants, the mammalian hrossa, the flightless avian seroni, and the reptilian pfifltriggi, and also the Oyarsa of Mars, a spirit Governor-General. He learns that the Oyarsa of Earth is bent, evil, and that he made an attempt to kill Mars by destroying the atmosphere, but that the Martians had dug deep channels down to the hot springs, and lived in huge cracks in the earth.

A story difficult to get, but worth looking out for, is Stanley G Weinbaum's *A Martian Odyssey.* Weinbaum was a brilliant writer who died young in 1935, but this tale, of the Martian called Tweel, his friendship with a Terran and their journey across Mars, is great fun.

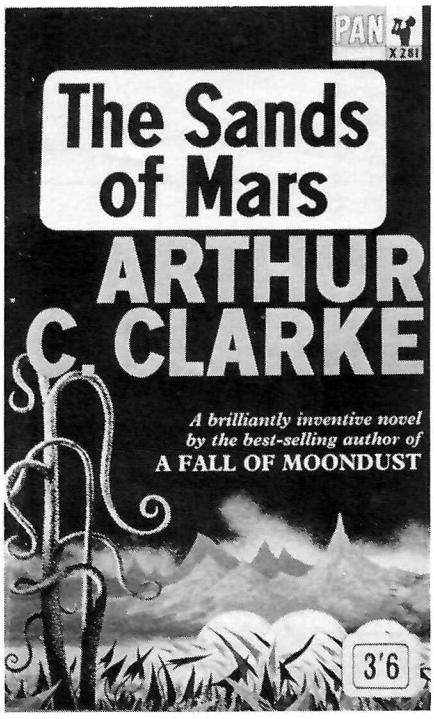
Martian chronicles

By now the idea of a dying race on a dying planet was at least popularly accepted. Ray Bradbury, a writer of inner space rather than outer, wrote largely of Mars in the spirit of Lewis Carrol's *Looking Glass World. The Martian Chronicles* otherwise known as *The Silver Locusts* so ineptly adapted to our television screens lately, depicts the battle between two cultures in an individual way. Humans reach Mars to find it inhabited by a race of non-scientific philosophers, who nevertheless have their own powers. The first few men are destroyed, but most of the Martians in turn are wiped out by a chickenpox germ, and men move in on the deserted planet. Earth destroys itself in war, and a few men start life again on Mars.

Our favourite episode is of the two men meeting one evening, out of time. Each is seeing a ghost against his own background, but the Martian and the Terran can communicate with his intangible opposite, and in the end they can accept each other's reality. In *A Rose for Ecclesiastes* Roger Zelazny depicts a rather unpleasant poet who falls in love with one of the dying race of Martians and tries to persuade them to live. Eric Frank Russell, in *Homo Saps* tells us that his Martians are telepathic (humanoid ones this time) but they do not communicate with humans, as there is a superior form of life on Earth.

And don't let's forget Isaac Asimov's *Lucky Starr* series, where a lad discovers the hidden Martian civilisation in a cavern, and is given powers to fight criminals everywhere. The *Space Ranger* as he is now called, does an impersonation of Superman around the solar system, but these are juvenile novels, of course. Heinlein picked Mars out of a mist of fantasy and placed it firmly back in the Solar System. He has at least three kinds of Martians, in various novels. The Martian in *Between Planets* is barely described, but we gather that he is frail, intelligent, and unable to move on heavier planets without his environmental shelter.

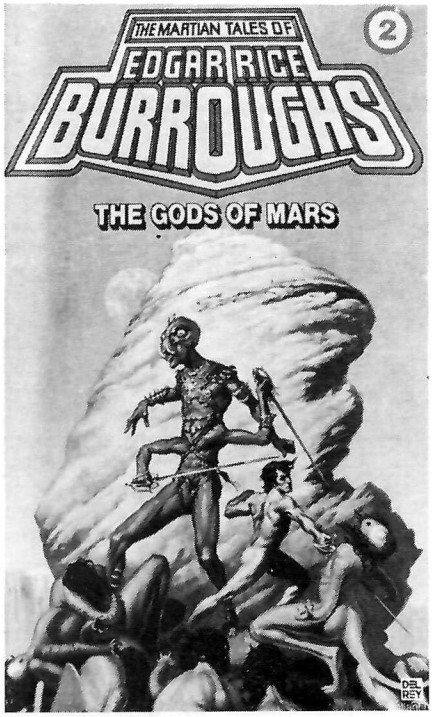
In *Double Star* the Martians are highly evolved, reproduce by fission, have a central



stalk from which limbs are extruded, and are ruled by propriety. They are not regarded as ignorant savages. Each adult Martian carries a 'life wand', a lethal weapon. A politician is kidnapped on the eve of being adopted into a Martian 'nest', and an out of work actor takes his place. The book is very fast moving, and we leave the Martians behind fairly soon, which is a pity.

Going underground

Robert Heinlein's favourite Martians are mentioned in at least two books, *Red Planet* and *Stranger in a Strange Land.* In *Red Planet* a



Terran boy finds a strange creature, described as a round fur-covered ball, which can extrude limbs, eyes, voice etc at will. He is christened 'Willis' and through the adoption the boy makes friends with the strange race that lives underground on Mars. Mars is so cold and bleak, that even the human colonists migrate to fit the seasons.

Red Planet is a juvenile novel, so we have wicked Government Agents, from which the good guys are saved by the Martians, but it is still a good yarn.

Stranger in a Strange Land shows the same Martians, but through the eyes of a human baby who has been brought up on Mars and meets humans for the first time as a young man. We learn the verb to 'grok', the essense of Mars. It means to love, to hate, to cherish, to appreciate. Female nymphs, the furry balls, are left to roam the planet until they are ready to be fertilised. When they lay eggs, they metamorphose into the male adult shape, and finally, when considered fit, die and become incorporeal 'Old Ones' who actually rule the planet.

Ray Bradbury tells the story of *The Blue Bottle,* a myth of a bottle left by the Martians, of which one drink will give you your heart's desire. Many humans search for this, and indeed find it, but their heart's desire perhaps was not what they expected. H Beam Piper's *Omnilingual* tells of an expedition to a Mars where the civilisation died out thousands of years ago. The planet is old, the atmosphere very thin. They never managed to split the atom and find enough energy to leave their world. The whole story is haunted by the ghosts of the dead race. A E van Voght tells of an *Enchanted Village,* where the sole survivor of a Terran expedition finds an old village hidden in the desert which still caters for the needs of the long dead Martians. In desparation he tries to convert it to his needs.

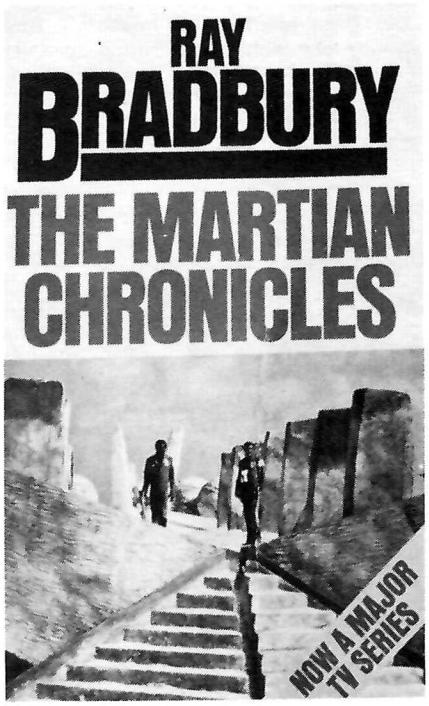
Hostile red world

The last group of Mars-based stories concentrates on humans struggling to adapt to a hostile world, from van Voght's *First Martian,* the story of an Andean Indian who can stand the low oxygen and atmosphere of Mars without a suit, but finds the other Terrans hostile, to John Brunner's *Born Under Mars* where humans are already adapting. One of the best of these is van Voght's *Etiam Crucifix,* where long term plans are already set in being to give Mars a breathable atmosphere, but the labourers find that they are becoming adapted to Mars so quickly that they can probably never return to Earth.

Ray Bradbury gives yet another different twist in *Dark They Were And Golden Eyed,* when humans come to dead Mars, and in a few months turn into dark-skinned golden-eyed Martians, speaking the Martian language and living in their houses and villas until the next group of Earthmen land.

Arthur C Clarke in 1951 wrote *The Sands of Mars,* a story of the first human settlements seen through the eyes of a visitor from Earth. Mars is more hostile than Clarke dreamed of, but he gives several ideas for making Mars easier to live on. In John Varley's *In the Hall of the Martian Kings* (1978), an Earth expedition is stranded on Mars, rather like the people stranded on the Moon in John Campbell's *The Moon is Hell.* But where the Moon colonists worked to provide themselves with necessaries, Varley belongs to the new generation of yarn-spinners. His Mars colony find that the Martians are not dead, merely hibernating until Mars wakes from its long winter, and there is already provision for their visitors.

In a way, *The Sands of Mars* and *In the Hall of the Martian Kings* typify the dual side of writing about Mars. On one hand the planet is cold, hostile and dreary, on the other there is a magic of somewhere far away. At least the fear of invasion seems silly now, and we will probably not be able to broaden our perspective by meeting another race, but if we need somewhere to experiment, it would be possible to terraform Mars, at a cost well within our means.



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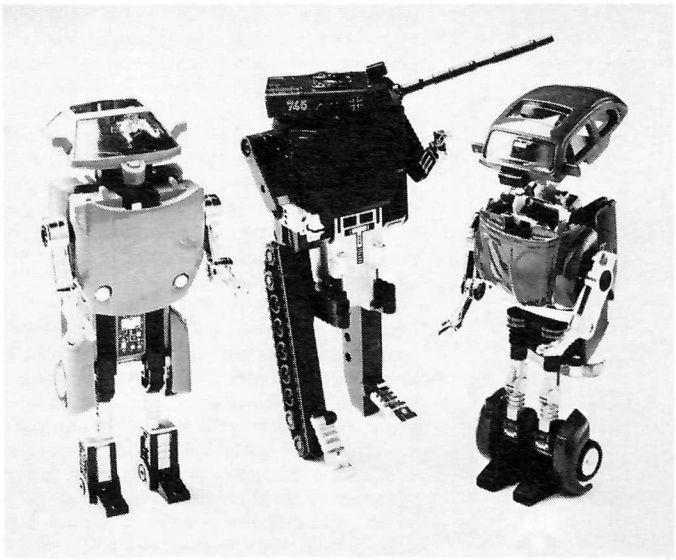


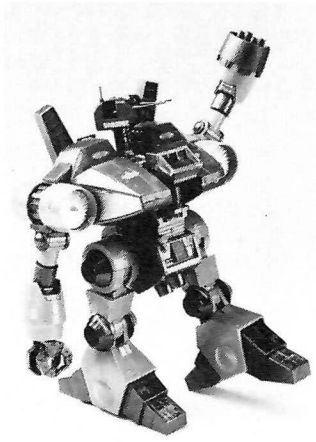
1984 British toy fair

The famous four **Palitoy** kits from the film *Return of the Jedi* – the A wing, B wing, X wing, and TIE Interceptor – will be available as singles during the second half of the year. **ERTL,** the company that now give us the Star Trek kits, are not planning any extension to this range. The only items which may be of interest are three die cast Star Trek ships and four figures which are about Star Wars size, but these will not be around until late '84. **TOYWAY,** a relatively small company compared with the big boys, have introduced Crusher Joe. There are four kits which include two fighters, a missile frigate and a land machine. Heavy Fox, also from the same company, is a small range of variable robots, which split into three units. **RICHARD KOHNSTAM** have joined the SF club with 19 kits from **ARII,** these being from the Orguss series and the Macross series from the latter company. There are different designs and scales to those already in the shops. **MONOGRAM** heritage series will be giving us their 1:48 scale lunar module and a 1:32 scale Apollo ship with see-through sections. The catalogue also shows a US/USSR missile set, although it is thought that this may not be available. Three other kits appertaining to Masters of the Universe will not be coming.

REVELL history makers include seven kits for you this year so start saving, although you won't have to find any £40's this time. On top of these there are three totally new science fact kits, all to 1:144 scale. These will be with us in May and July. **HASEGAWA,** would you believe, are doing a 1:200 scale Shuttle. This must a backup craft to add to your collection of airliners! No release date yet. This of course comes from the **AMERANGE** company, as do also the **IMAI** range of kits and this year we have 19 from **Macross,** 13 from **Mospeda,** seven from **Orguss,** 48 minifigs from **Robodatchi,** a Space Shuttle set and a unimat? Little is known of the last three at this time. Last but not least, **BANDAI** Xabungle (pronounced zabungle) have announced 24 kits.

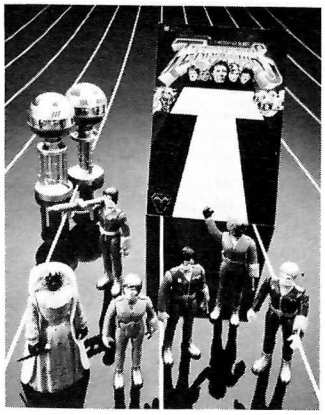
All kits mentioned in this item will be available during 1984 through your local hobby shop or the space centre JONES MODELS.

BS



Terrahawks

Action figures from **Bandai UK Ltd** featuring five *Terrahawks* characters are now available. Each figure is styled as an exact replica of the popular TV characters and comes complete with action belt and wrist gun. Also available will be Space Sergeant Major Zero and Space Sergeant 101. These superbly detailed Zeroids have moving eye shutters and detachable heads. Finally, to complete the set, there is the arch villain Zelda, wearing her cape and carrying her cane. The approximate retail selling prices of the figures begin at £1.65. **IG**

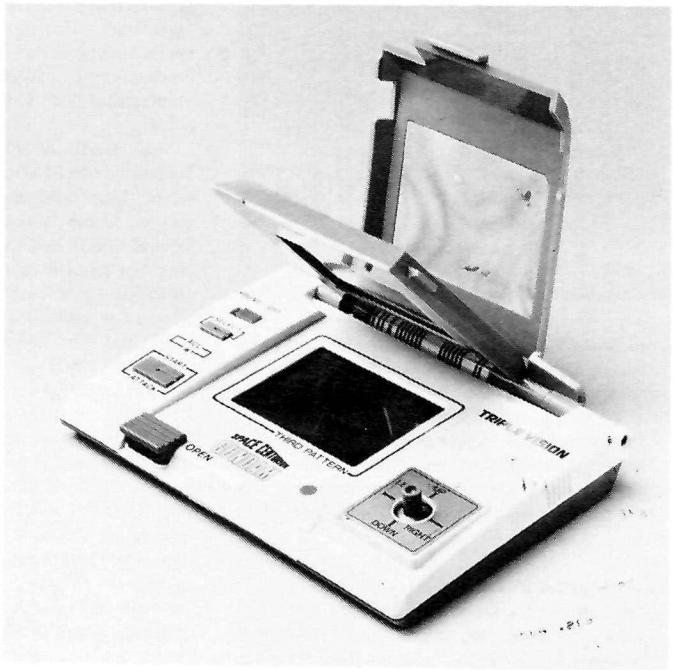


Optical fibres

Polytechnic call themselves 'the bright ideas people'. They specialise in optical fibres, colour filters, connectors and the means of getting light into the fibres – Light Emitting Diodes (LEDs) and filament lamps. They can also supply twist drills, Veroboard, connecting wire and assorted other constructional aids for modellers. For instance, if you don't like the unsightly spaghetti junction of wire inside your model, try using adhesive copperfoil tape instead. For full details of products available, contact Polytechnic, 182 Harrington Road, Workington, Cumbria CA14 3UJ. **IG**

Space Centurion

This unique LCD game features three separate games in one compact housing. There are three separate screens, each depicting alien spaceships and robots attacking a space station. The Space Centurion is the defender used to destroy the aliens. Each game requires a minimum score to be attained before the player can move on to the next screen. Approximate retail price is £27. **IG**



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Fast glass

Glass fibre and resin have been used for years to repair damage to car bodies and fill holes in mouldings. A household name in the field is Isopon. The makers of Isopon have now announced a new product called Fastglas, which allows you to make your own Glass Reinforced Plastic (GRP), the sort of material boat hulls are sometimes made from, at home. For a free information sheet on Fastglas, send a stamped, addressed envelope to W David & Sons Ltd, Ridgemount House, 1 Totteridge Lane, London N20 0EY. IG

Space Guardian

LCD table-top games are the latest style to arrive from Japan. They offer a sophisticated colour screen and many of the features of the full size arcade games. **Bandai** is presenting Space Guardian in which the player attacks and defends against enemy spaceships and missiles. The approximate retail selling price is £25. IG

Thunde-rin guns

This new release from Standard Games & Publications Ltd is an excellently produced fun game for 3-6 players which can be quickly learned yet calls for considerable skills and a certain amount of luck in its play. It features the town of Dry Gulch, and it is in effect a contest between the Sheriff, the outlaw leader, and up to four gunmen. The Sheriff wants fame, the outlaw gold and the gunmen gunskill points.

The board features the town buildings and the outlaw hide-out, a ranch, Indian encampment, prospector's shack, etc. Most of these contain gold, which can be stolen by the outlaw, and all of them have non-player characters who can be recruited or attacked by the players. In addition, a chance element brings on a railway train and a stage coach at intervals. The game is slightly biased in favour of the Sheriff (in my games he hasn't lost yet!) but not enough to make it uninteresting.

The mechanics of the game are easy to pick up and well devised. A game will last an hour or two, and played in the right spirit can be a lot of fun. I thoroughly recommend it. TB

Speed & Steel

Speed & Steel concentrates more on organisation and production tham mere warfare. Set in 1930-1940, it is for two players who represent two vaguely European countries which are on a collision course. Each side strives to build up its industry and raise its standard of living. In doing so it can use the industrial potential in a number of ways. It can spend points on peaceful things, it can spend them to increase its production capacity, or it can spend them on building up its actual military forces.

This is where the strategy comes in, because with so many choices and options it is extremely difficult to achieve a properly balanced game plan. If you concentrate on a steady build-up of industrial power and neglect your armed forces, you are helpless if your opponent opts for rapid military expansion and a quick war. Since even the same two opponents will probably not use the same game plan in two different games, this means that each game will be quite different.

As usual with Standard Games & Publications, the game mechanics are simple and easily picked up, and the charts and tables are readily followed. TB

Siege

Some years ago Standard Games & Publications produced a mediaeval boardgame system entitled Cry Havoc. This combined a simple, playable set of rules with beautifully drawn and vividly coloured artwork.

This system, which dealt with mediaeval warfare in and around a village, has now been expanded to include the siege and defence of a mediaeval castle. The high standard of the artwork on counters and maps has been retained, and many of the games systems of the earlier game are also retained, with the addition of special rules for the various siege engines of the period. Siege can be played on its own, or combined with the original Cry Havoc counters to make a mammoth game.

The rules include seven different scenarios, ranging from the simple attempt at treacherous seizure of the castle by guests within the walls to the complex attempt at raising a full siege, in which the Cry Havoc counters are needed, and other intermediate types which teach the values and advantages of the different weapons.

This game is an ideal means of dealing with sieges which occur in a mediaeval campaign and which tend to be dull and time-consuming on the wargames table, yet unsatisfactory if decided by a mere dice roll. All those gamers who possess and regularly play Cry Havoc would be well advised to add Siege to their games library and quite literally double their enjoyment. TB

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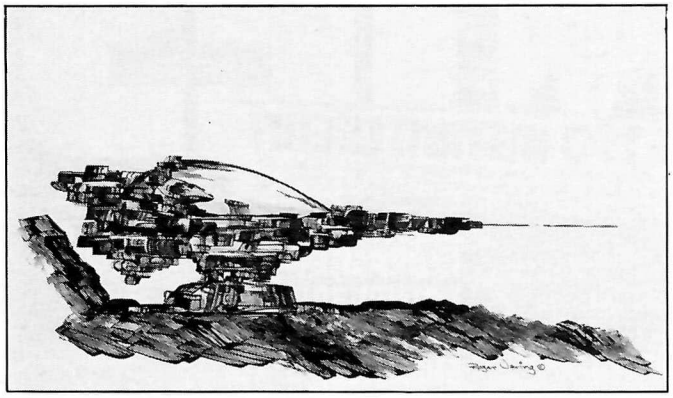
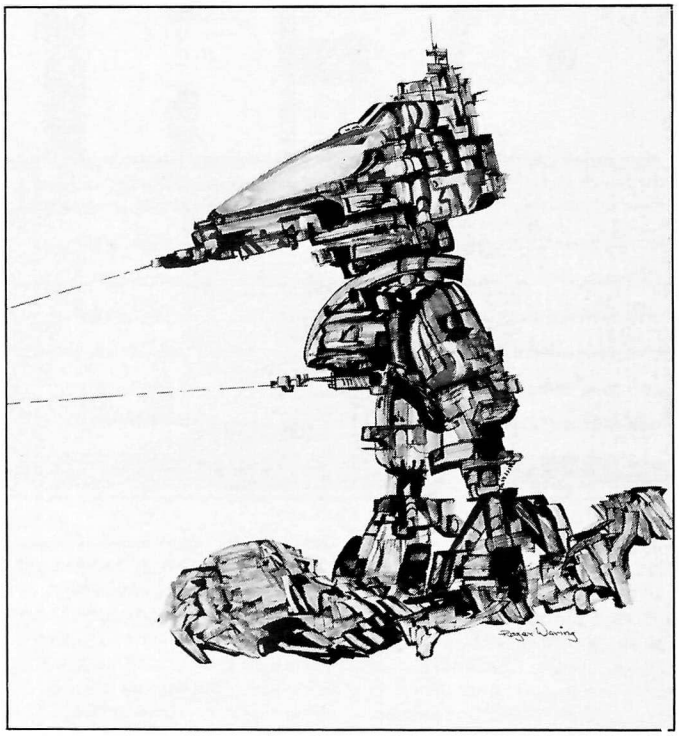
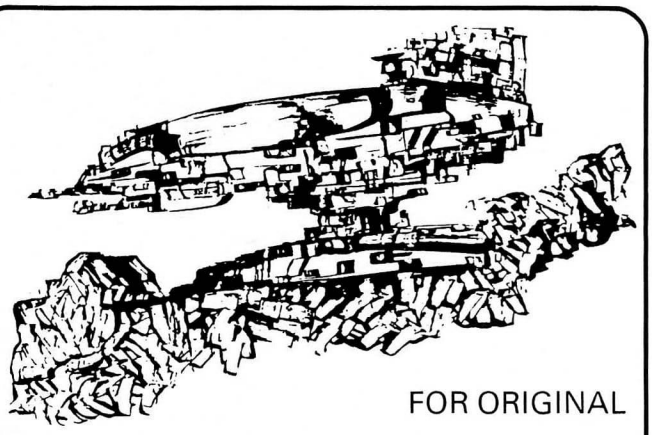




Robots & Rayguns

Science fiction artist Roger Waring can supply a range of SF illustrations by mail order. At the moment they include hand drawn, hand tinted fantasy hardware – a Civilian Reconnaissance robot, a Ground Defence Laser and a Ground Attack Droid – available in different sizes. Prices start from £1.00. The largest print currently available (16×20 inches) is only £4.00. Roger plans to extend his range of products to include limited edition prints, SF stationery and a series of full colour miniprints featuring SF hardware. Further details of Roger Waring's science fiction artwork supplies can be obtained by writing directly to Robots & Rayguns, 48 Woodbreda Drive, Saintfield Road, Belfast BT8 4HZ, Northern Ireland. IG



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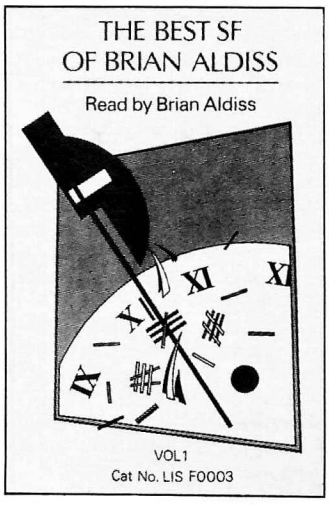

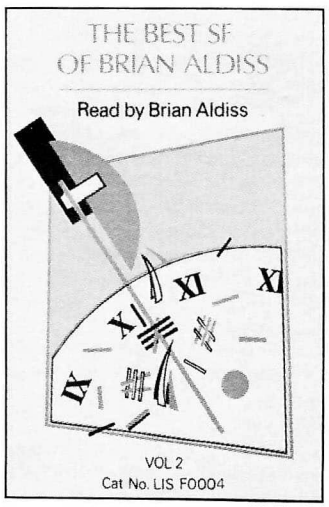

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1. Lieutenant Saavik
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5. Eugenic Wars
6. San Francisco (The city in which he lives)
7. The Matura Nebula (Spock uses this saying to demonstrate that once inside the Nebula the odds between Enterprise and Reliant will be even)
8. Prefix Code (Used to prevent an enemy from tapping into the other ships console. Reliant's code is 16309)
9. He re-programmed the simulation computer
10. Spock utters before he dies – 'The needs of the many outweigh the needs of the few or the one.'

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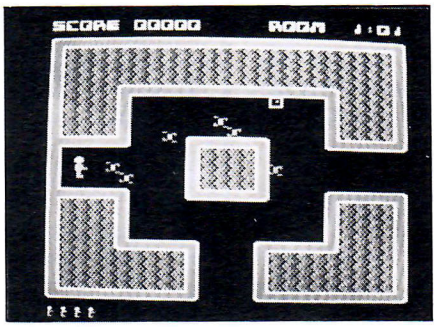
MICRO WARS

Continued from page 47

may be automatic or manual. Almost everything you do consumes energy. If you run out of energy, your shields and scanners break down and the ship is vulnerable to attack until the auto-repair system comes into operation. If you do get into difficulty, you can escape in a survival capsule, after which, starfleet command will decide whether you're a fit person to entrust with another starship.

A good game with good graphics, although I have one reservation. The screen display is black and white. As you may know, the Acorn Electron, in common with its big brother (the BBC Micro), has very sophisticated display facilities, including colour and high resolution graphics which can be mixed with text at ease in most of seven display modes. It seems a pity to restrict this game to black and white.



Title: Cybertron Mission
Micro: Acorn Electron
From: Program Power Ltd
8/8a Regent Street
Chapel Allerton
Leeds LS7 4PE
Tel: (0532) 683186.

Fort Cybertron is a maze of rooms. You have to work through them collecting objects specified by the program. When you've collected all the treasure on a floor, head for the room with the safe. Touching the safe moves you on to the next level. Of course, it isn't that simple. There are nasty characters awaiting your arrival and their one reason for existing is to stop you removing items from Fort Cybertron. Spinners on the first level automatically follow a collision course for you, but they don't fire back. Later on, though, the dreaded Clones do fire back. And as for the Cyber-droids, they don't bear thinking about.

Cybertron Mission features excellent colour graphics – a very good game indeed.

Next issue: The Sinclair Spectrum is one of the most popular home computers available today, with an overwhelming range of software from the nation's software houses. Next issue, we bring you more space game software for the Spectrum from Crystal Computing, Mikro-Gen, CDS Micro Systems and others.

NEXT ISSUE

INTERSTELLAR TRAVEL
David Hardy turns his attention to the vast distances between the stars and how we might bridge them. Reaching other stars means contacting other planetary systems, the most daring feat of exploration the human race has ever undertaken.

STAR-FINDING
You can take up astronomy on a shoestring by investing in a relatively inexpensive pair of binoculars (see 'Astronomy on a Shoestring' in this issue). But how do you find what you want to look at in the vast black void of the night sky? Patrick Moore to the rescue.

THE INFORMATION REVOLUTION
Computers and high speed telecommunications can ferry information around the world in the blink of an eye. That information might represent television pictures, computer data or voice messages. What are the implications of the wired society?

SPACE ACTIVIST SOCIETIES
Futures consultant Andrew Nimmo reports on the societies that make it their business to promote spaceflight.

SUPERGIRL
Johnny Black takes his life in his hands and corners Supergirl for Space Voyager.

TOP TEN HOME MICROS
The United Kingdom is taking up computer-mania faster than any other country in the world – America included. What is the magic of the micro, which are the best sellers and why?

EARTH-CROSSING ASTEROIDS
Tiny worlds routinely cross the Earth's orbit. Dr J K Davies of Leicester University reveals the strange behaviour of Earth-crossing asteroids.

AND MORE . . .
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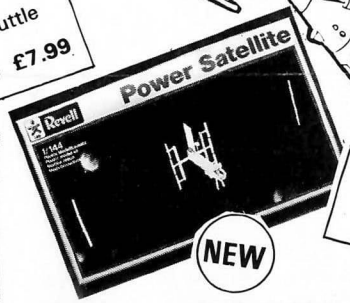

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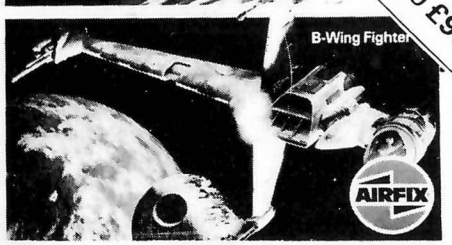

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